MACHINERY

Design—Construction—Operation

Volume 46 OCTOBER, 1939 Number 2

The design of universal drill jigs will be one of the subjects dealt with in November MACHINERY. Other articles will deal with the making of ammunition for the United States Army at Picatinny Arsenal, special methods used in a jobbing crankshaft plant, welded and cast frame construction in press design, heat-treating methods, and hydraulic systems developed for the control and operation of a small grinder.

Several advertisements in this issue of MACHINERY were printed before announcement had been made of the postponement of the Machine Tool Show in Cleveland. These advertisements, therefore, still carry reference to the show.

Product Index 263-278

Advertisers Index 281-282

PRINCIPAL ARTICLES IN THIS NUMBER

American Industry Presents the World's Finest Machine Tools.. 65

Social Benefits Derived from Machine Tools
By Wendell E. Whipp 66

Latest Achievements of the Shop Equipment Builders..... 68

Machine Tools in the Aircraft Engine Industry
By J. Carlton Ward, Jr. 72

Need for High-Production Inspection Machines
By William F. Pioch 78

Spending Millions to Re-Equip Army Arsenals
By Brigadier General Charles T. Harris, Jr. 84

The Machine Tool Builder's Next Goal.....*By A. W. Seacord* 90

Taking the Mystery out of Machine Tool Operation
By B. G. Tang 96

Making the Special Machine Tool Less Special..*By O. W. Young* 102

Selling Machine Tools to the U. S. Navy
By Rear Admiral H. G. Bowen 108

How Can We Reduce Idle Machine Time?.....*By J. R. Weaver* 114

Future Trends in Equipment for Surface Finishing
By David A. Wallace 120

Machine Tools in the Tractor Industry.....*By James R. Munro* 126

The Twenty-First Annual National Metal Exposition..... 149

Editorial Comment 150

MACHINERY Wins First Prize for Editorial Achievement..... 151

A Manufacturing Executive Pays a Tribute to the Machine Tool Builder.....*By William Watson* 152

The "Ekko" Process for Making Iron Dies..... 153

Ingenious Mechanical Movements..... 156

New Trade Literature..... 159

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The postponement of the Machine Tool Show need not interrupt your plans to witness the performance of the machines illustrated on the opposite page. Lodge & Shipley extends to you a personal invitation to visit them at their plant where these machines are on display and in operation the year around.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO

MACHINERY

Volume 46 NEW YORK, OCTOBER, 1939 Number 2

American Industry Presents the World's Finest Machine Tools

THE steady advance made by the American machine tool industry in providing constantly improved machines and equipment is the theme of this number of MACHINERY, which illustrates and describes over one hundred and fifty new and improved machines just introduced. Most of these machines would have been on exhibition at the Machine Tool Show planned to be held in Cleveland this month, but which, due to unforeseen conditions, it was deemed advisable to postpone.

MECHANICAL executives throughout this and other countries will find in this number of MACHINERY a thorough and comprehensive review of the important developments recently made by American machine tool builders. They will be able, through a study of this review, to follow closely these developments and to benefit by their application in their own plants. They will be able to keep this number as a summary for ready reference, pertaining to recent important developments.

IN reviewing some of the recently introduced machines, it will be noted that a steady advance is being made in regard to the application of electric control and hydraulic operation. The operator's task is being constantly simplified, some machines being completely operated by merely pressing push-buttons. The sturdiness of present designs is in evidence, practically all machines using cutting tools being designed for the advantageous use of the new high-speed cutting materials.

AS regards appearance, the machines have also undergone a great change. There is about most of them a gracefulness that harmonizes with modern conceptions of design. In some instances, this has been achieved by cooperation between the engineer and the industrial artist; in others, the engineers have achieved commendable results by following their own conceptions of harmonizing the appearance with the utilitarian purposes of the machines. All in all, the new machines are a credit to the machine tool industry.

WENDELL E. WHIPP

Social Benefits

By WENDELL E. WHIPP
President, National Machine Tool Builders Assn.
President, The Monarch Machine Tool Co.
Sidney, Ohio

The greatest contribution that machine tool manufacturers can make to the welfare of the nation at this time, according to Mr. Whipp, is to concentrate their entire efforts on the production of the largest possible number of machine tools. The immediate effect of the war will be a quickened demand for all the products of industry. American manufacturers must now furnish the normal needs of nations who have been trading with the countries now at war and who can no longer be served by those countries.

IN connection with the publication of this number of MACHINERY, devoted chiefly to new developments in shop equipment, it is fitting that the great benefits that have accrued to the people of this nation from the use of machine tools and the machines built by machine tools should be emphasized. On this occasion, we may well take an inventory of the most important facts relating to the effect of machine tools on the welfare and living conditions of our people.

GOVERNMENT compilations show that, over a considerable period of time, industrial employment has increased practically in a direct ratio to the progress of mechanization, and as a result of it. It is also easy to show that along with this increased industrial employment has come a steady reduction in the prices of a long list of manufactured goods, due to the fact that the machine makes possible quantity production at lower costs.

TO indicate the effect on retail prices, the figures quoted in the following have been taken at random from "A Study of Typical Consumer Goods Items," compiled by Sears, Roebuck and Co. The prices are taken from this company's catalogues, and, as stated by the company, are "representative of prices paid by consumers nationally."

ACCORDING to this compilation, for example, cotton blankets that in 1923-28 sold at $2.33 were priced at $1.37 ten years later. Felt-base rugs selling at $8.25 in 1927, were priced at $4.70 in 1937. Electric washers selling for $66.50 in 1929-30, were priced at $33.28 in 1933-37. Oil ranges were reduced from $36.33 to $26.96 in a ten-year period, and one grade of electric irons was reduced from $1.98 to 89 cents. These are just a few examples of hundreds of average retail prices that could be quoted. A similar comparison with respect to practically all the devices and conveniences that have added to the comfort of living would tell exactly the same story.

WHAT about wage earners? There is no need to go into details to prove that hourly wage rates today, in spite of the long depression from which we are just emerging, are, on the average, the

Derived from Machine Tools

highest in the history of the country. It is extremely significant that, on the whole, those industries in which progressive mechanization has been the most consistent are exactly the industries which are paying the highest wage rates. Furthermore, it is no coincidence that the greatest employment increases within the last fifteen years have been in those same industries.

NEXT, what has happened to the returns on the investments made in industrial enterprises? Have greater profits been obtained through the installation of better machinery? The answer explains, I believe, the function of the machine in a democratic society and provides a complete reply to the charge, so common nowadays, that the machine functions solely for the benefit of the employer.

IT is certain that such profits as have been realized by manufacturers would have been impossible without the consistent application of constantly better machine tools and other productive equipment; but the major share of the "savings" effected by progressive mechanization has, of necessity, been passed on to the consumer in the form of lower prices or better quality of merchandise, and to the wage earner in the form of higher wages. The inexorable pressure of competition and the insistence on higher living standards, engendered largely by the sales promotion of the products of increased mechanization, have seen to it that the manufacturer could keep for himself only a limited share of the benefits derived from improved machinery.

IF each industrial field were a monopoly—or if, as in fascist countries, the government controlled business by decree, suppressing the law of supply and demand—it is conceivable that all of the benefits of mechanization might be kept for the stockholders or for the government, as the case might be, and practically none passed on to the consumers or the wage earners. But the very essence of our American system of living and doing business is that of wide-open, keen competition. The moment anyone tries to keep for himself any more than a marginal share of what he saves by the installation of better productive facilities, some one else comes out with a product just as good at a lower price, or a better product at the same price.

GRANTED that it is sheer necessity and not humanitarian considerations that brings about this result, the fact remains that it is the combination of the profit motive, progressive mechanization, and free competition that constantly brings down the prices of the products of our industrial civilization, improves quality, and raises the standard of living.

NOW what is it that has made it possible for wages to rise in the face of a competitive struggle which has constantly brought prices down? Here, again, the answer is the machine, for the simple reason that the machine multiplies a hundred- or thousand-fold the output of the individual worker. And, coming back to the stockholder and to profits, how has any business succeeded in squeezing out a profit margin with wages going up and prices going down? The answer remains the same—it is better machine tools, better productive equipment, that has enabled management to get more product out of the operating dollar.

WE inevitably come to this conclusion: While the profit motive prompts the installation of new machinery, the broad results from the standpoint of society are lower prices, better merchandise, higher wages, and the employment of capital in productive enterprises with some expectation of a reasonable return.

WITH regard to the social benefits derived from machine tools, I therefore present these general conclusions:

Machine tools represent the key to our whole scheme of mechanization.

Most of the productive work of industry is done with metals. To put metal to use, it must be converted into the shape required for that use. This is the function of the machine tool—turning, boring, drilling, milling, grinding, and planing machines are all means of transforming inert metal into living, functioning parts of practically every machine or mechanical device known to mankind.

Machine tools are the machines that build machines. They not only help to make all the machinery that turns out consumer products, but they, themselves, turn out many consumer products directly. Without machine tools, the entire industrial equipment of the world would be non-existent. If all machine tools could suddenly disappear, the clock of civilization would be turned back more than a hundred years; but with machine tools, the clock of progress advances at a very rapid pace.

Latest Achievements of the

Machine Tools and Other Metal-Working Equipment Originally Scheduled for the Cleveland Show are Here Introduced for the First Time

Clearing Hydraulic Presses Introduced in a Variety of Types

Hydraulic presses applicable to a wide variety of work and available in various sizes and in single-action single-pressure, single-action double-pressure, double-action, and triple-action types are being introduced on the market by the Clearing Machine Corporation, 6499 W. 65th St., Chicago, Ill. The mechanical features of the crankless power presses built by this concern are combined in the new line with a simplified hydraulic operating system. The single-action double-pressure hydraulic press here illustrated has a capacity of 500 tons; it has a bed area of 42 by 38 inches, and a stroke of 24 inches.

The dual pressure hydraulic system gives a rapid approach stroke, a high-speed pressing stroke up to a pressure of 175 tons, a slow-speed high-pressure stroke that exerts between 175 and 500 tons, and a rapid return stroke. These combined characteristics give the press an operating speed of 14 strokes a minute.

The all-steel frame consists of a bed, two uprights, and a crown. These structural units are keyed in all directions and are held together by tie-rods, keeping the frame in alignment, even though the load should exceed the maximum capacity of the press.

The machine is a self-contained unit and requires no pit or other space for auxiliary equipment. The hydraulic system, including the pump, drive motor, operating valves, auxiliary pump, oil filter and cooler, is assembled on one plate and mounted on top of the press. This assembly is fully enclosed by a hood to protect it from grit and dirt.

The front and rear of the press are practically identical, and the symmetry of construction permits the loading of dies from either front or back. There are no protrusions or overhanging gears to endanger the safety of the operator, and it is possible to position multiple units close together in progressive production operations.

All controls are electrically operated through push-buttons. There are controls for sensitive inching up or down, for a full automatic cycle, and for adjustment of the pressure and stroke. All electrical equipment is housed within the frame.

Three hydraulic rams actuate the slide. Two small rams provide the quick approach and quick return strokes. The main center ram, which is of an entirely new design, gives the fast and slow speeds at the pressures previously mentioned. The change-over from the high-speed pressing stroke to the slow-speed stroke takes place automatically. The hydraulic arrangement was designed to eliminate auxiliary rams and cylinders, valves, and piping, resulting in a fast action. The main surge valve is of a new design that gives a shockless action. The slide has a positive knock-out to guard against any possible accident. An opening of 18 by 18 inches in the bed is machined to receive air cushion equipment within the press structure.

Clearing Hydraulic Press, with Combined High-speed Approach, High- and Slow-speed Pressing, and Rapid Return Stroke

Shop Equipment Builders

These Articles Describe Outstanding Features of Machines Designed to Meet Today's Production Problems in Manufacturing and Tool Shops

Giddings & Lewis Horizontal Boring, Drilling, and Milling Machines

High-power precision horizontal boring, drilling, and milling machines of a new heavy-duty design known as the 50 series, have been announced by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., in the floor type model illustrated in Fig. 1. This 50 series line also includes table and planer types. The machine shown has a main spindle 6 inches in diameter, a 2 1/2-inch auxiliary spindle, 96 inches of headstock travel, and 192 inches of column travel on the runway. The machine weighs about 85,000 pounds, and has an over-all height of approximately 18 feet.

Design features of the new machines, in addition to the two spindles, include independent operation of units, a rotary feed selector, a wide range of boring and milling feeds, direct-reading dials, an automatic depth gage, safety limit switches, and scales and adjustable verniers. Particular attention has been given to the electrical controls tc provide wide flexibility and easy operation.

Another recent Giddings & Lewis development is the horizontal boring, drilling, and milling machine shown in Fig. 3, which incorporates all the features of the standard 30 series table type machines and has, in addition, a built-in power revolving table. This feature increases the flexibility of the machine and reduces the set-up costs. The table enables a job to be revolved to any position within the full 360 degrees of movement, thus permitting work to be machined on different sides in one set-up and eliminating the necessity of mounting and dismounting an auxiliary revolving table for operations of that sort.

The table top is approximately 7 inches lower than that of a standard table type machine equipped with an auxiliary revolving table. This means an increase in the vertical range of the headstock and greater convenience for the operator. Greater rigidity is also obtained because of the fact that the revolving table is an integral part of the machine and mounted closer to the bed. The rotary movement of the table can be actuated at eighteen different feeds and at a rapid traverse. Eighteen other feeds and a rapid traverse are provided for cross-travel of the table. The table is graduated to 1/2 degree and is provided with four indexing stops. A hand adjustment to 0.001 inch is obtained through a micrometer dial at 90-degree intervals. Additional indexing intervals can be provided for if desired.

The various units of the machine can be actuated simultaneously or separately, facilitating the milling of irregular contours. There is a directional control for the table, saddle, and headstock movements, the levers being moved in the same direction as the desired unit movements. A depth gage and automatic trip eliminate the necessity of constant attention on the part of the operator. Verniers are adjustable

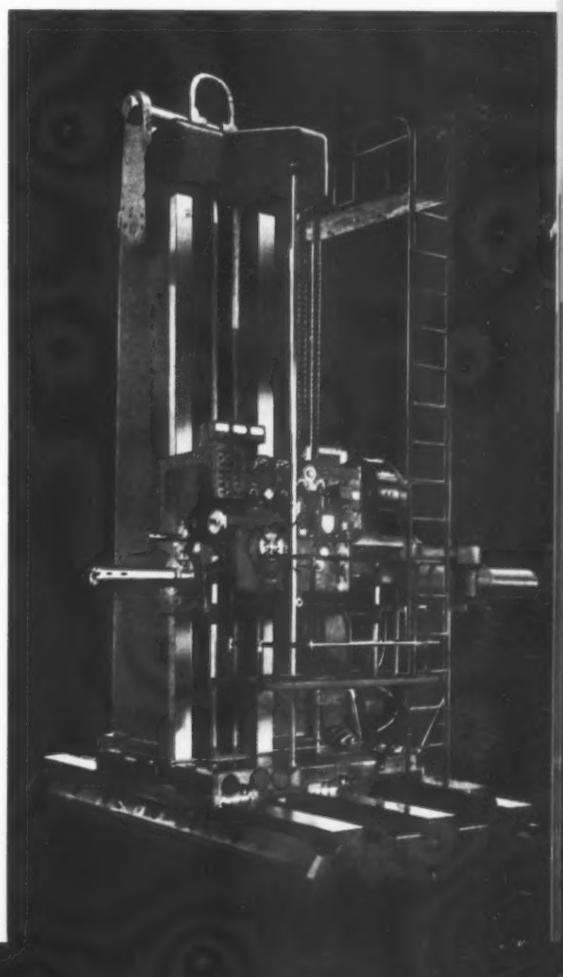


Fig. 1. Giddings & Lewis Horizontal Boring, Drilling, and Milling Machine of the New Heavy-duty 50 Series

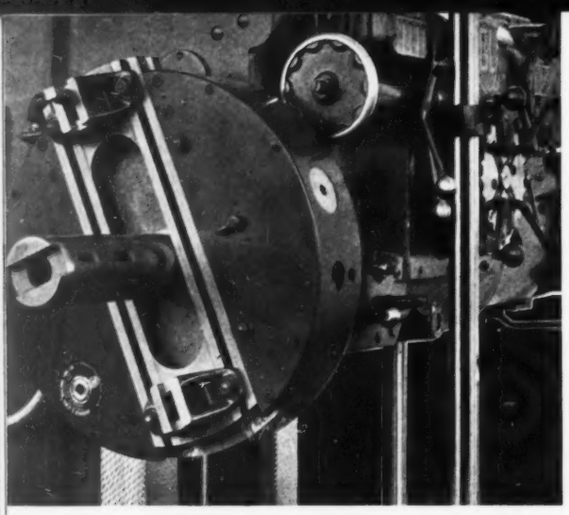


Fig. 2. Continuous-feed Facing Head Applicable to All Machines of the Giddings & Lewis Line

to the nearest inch, which simplifies calculations.

The continuous-feed facing head illustrated in Fig. 2 is a new accessory of unusual flexibility which is adaptable to practically all of the machines built by the company. This head is arranged for attachment to the spindle sleeve and is provided with a hardened and ground bushing through which the main spindle can slide freely. This makes it possible to perform facing and boring operations at the same time.

Six continuous feeds from 0.006 to 0.125 inch per revolution are available for feeding the cross-slide in facing operations. When the power feed is disengaged, this attachment provides a large off-set head for single-point boring. A micrometer dial graduated to 0.001 inch facilitates adjusting the cross-slide for this class of work. The cross-slide has T-slots for tool-holders.

Cleereman Jig Borer and Sliding Head Drilling Machine

An improved jig boring machine (Fig. 1), designed for high accuracy and speed of control, is announced by the Cleereman Machine Tool Co., Green Bay, Wis., for which concern sales are handled by the Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill. This machine is intended both for use in the making of jigs, fixtures, tools, gages, etc., and for manufacturing innumerable parts required in small quantities.

Either precision hardened and ground lead-screws or end-measuring rods can be used in the operation of this jog borer, and it can be equipped with a power rapid traverse to the table and carriage in both directions. The power rapid traverse is obtained by means of built-in motors which drive the lead-screws through worm-gearing. The machine is equipped with a spindle depth gage, a micromatic sliding-head gage stop, an automatic tapping reverse, and a feed clutch designed for speedy operation. There is a Bijur oil system and a coolant system.

Twelve speeds in the ratio of 20 to 1 are available in two ranges, and when a wider range is desired, a ratio of 40 to 1 can be provided through the use of a two-speed motor. Single lever selectors for feeds and speeds are provided, and there are direct progressive-reading speed and feed dials. The direction of spindle rotation is controlled by means of a reversing type motor, the spindle being stopped automatically by a brake on the motor.

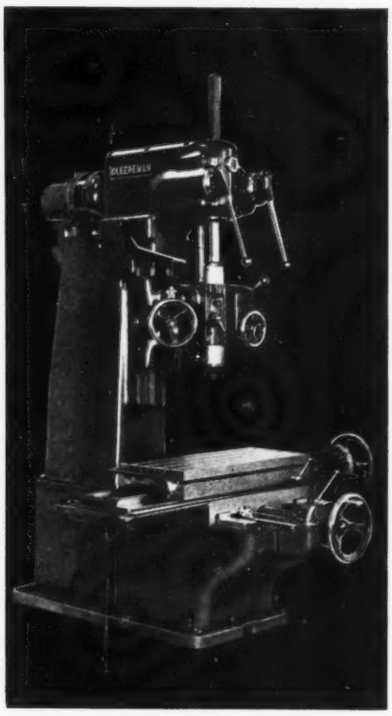


Fig. 1. Cleereman Jig Boring Machine with Speedy Control Features

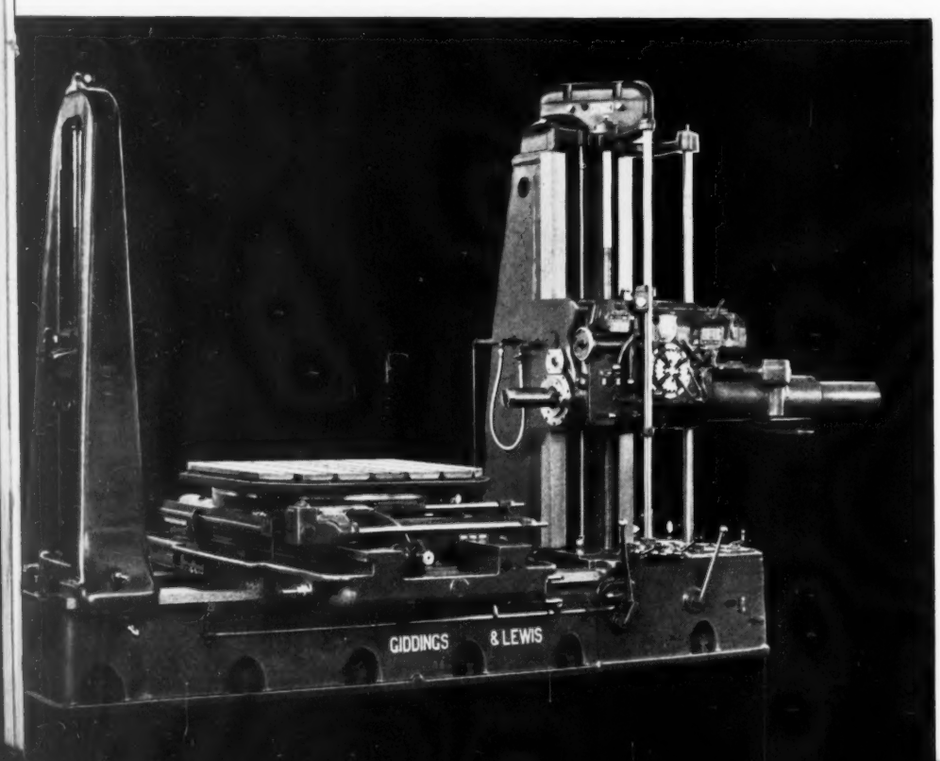


Fig. 3. Boring, Drilling and Milling Machine with Built-in Power Revolving Table, Made by Giddings & Lewis

This concern has also brought out a 25-inch round-column sliding-head drilling machine (Fig. 2).

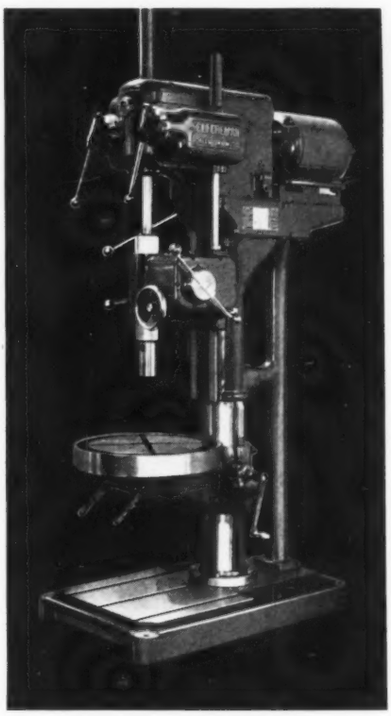


Fig. 2. Cleereman 25-inch Round-column Sliding-head Drilling Machine

Twelve spindle speeds from either 50 to 1000 R.P.M. or 75 to 1500 R.P.M. provide for drilling and boring holes from 3/16 inch to 6 inches in diameter at the proper peripheral speed of the tool. Feeds from 0.005 to 0.045 inch per revolution are available to suit drilling, boring, and reaming operations.

A distinctive feature of the machine is the use of a reversing motor in place of forward and reverse friction clutches. A lever on the left-hand side of the head operates built-in push-buttons, which control the forward and reverse rotation and the stopping of the spindle. This method of control is especially useful in increasing the speed of performing tapping operations.

Fig. 1. Racine Shear-cut Production Saw with a Capacity of 8 1/4 by 9 3/4 Inches

Racine Metal-Cutting Machines

A new machine recently announced by the Racine Tool & Machine Co., 1725 State St., Racine, Wis., is a shear-cut production saw (Fig. 1) for cutting material 8 1/4 inches high by 9 3/4 inches wide. This machine is provided with screw feed and quick-acting swivel vise. The saw frame is of hollow construction, with bearing plates bolted through the frame, permitting the flexing of the frame arms without misalignment of the bearing surfaces. The drive is by a 2-H.P., 1200-R.P.M. motor. Three speeds are available.

Fig. 2 shows a machine equipped with the company's new hydraulic automatic stock-feed attachment. This machine, through a low-pressure hydraulic system, feeds the stock forward in desired lengths, as determined by a single indicator having a graduated scale; clamps and releases the vise jaws; engages the clutch; and feeds the saw guide up and down at the correct cutting speeds. This complete cycle is entirely automatic, the operator being left free for other work.

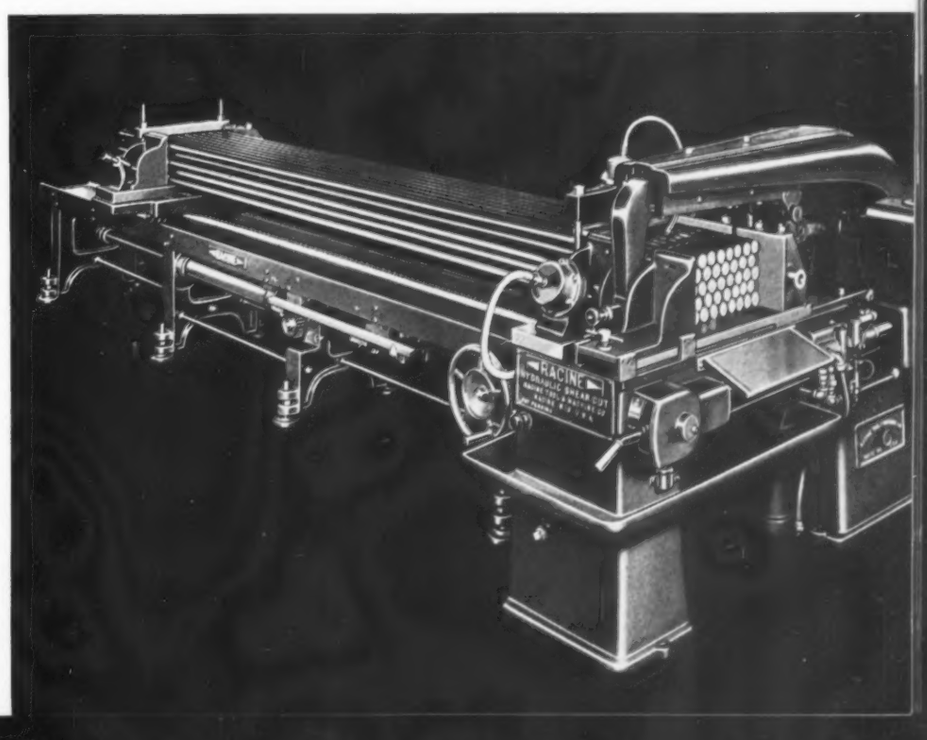
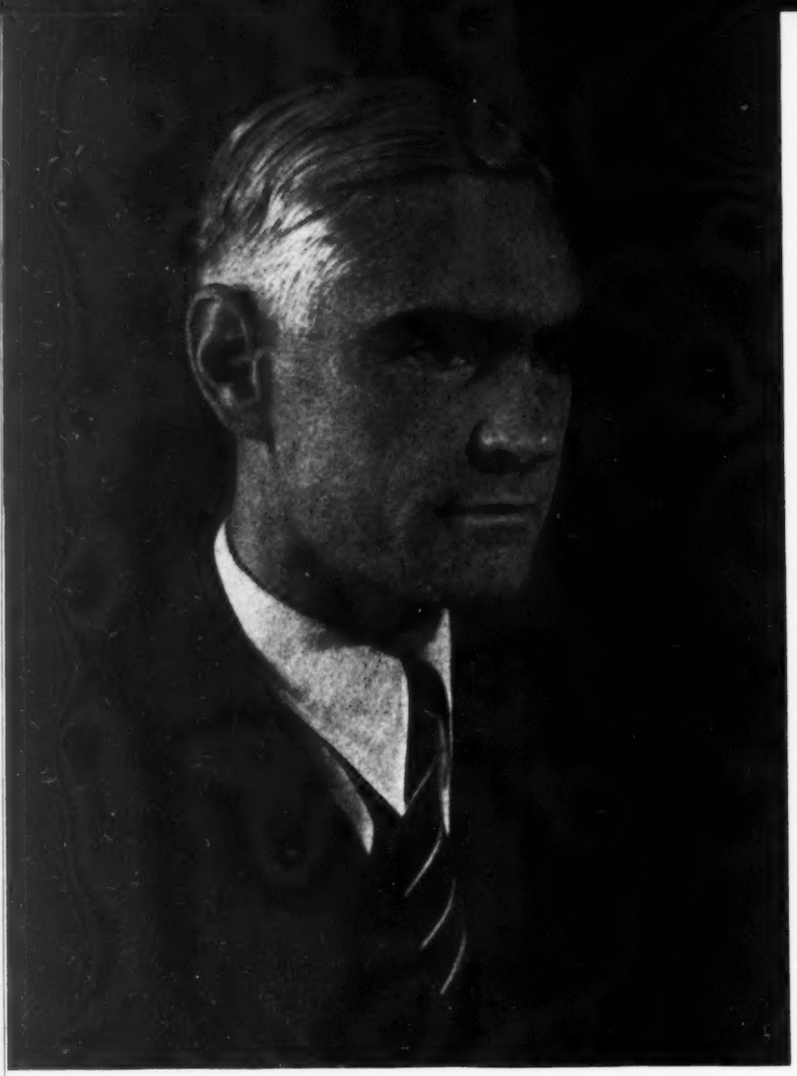


Fig. 2. Racine Hydraulic Automatic Stock-feed Attachment Applied to a Shear-cut Saw for Continuous Operation



J. CARLTON WARD, JR.

Machine Tools

By J. CARLTON WARD, JR.
Vice-President and General Manager
Pratt & Whitney Division of
United Aircraft Corporation,
East Hartford, Conn.

J. Carlton Ward, Jr., vice-president of the United Aircraft Corporation and general manager of the Pratt & Whitney Aircraft Division of the corporation, was born in Brooklyn, N. Y. He graduated from Cornell University as a mechanical engineer. In 1925, he was works manager for the Pratt & Whitney Division of the Niles-Bement-Pond Co., in which plant the Pratt & Whitney Aircraft Co. developed and built its first engine. He then became vice-president and general manager of the Hartford Machine Screw Co., and later was for five years with the General Cable Corporation in charge of manufacturing. Returning to Hartford in 1935, he was first assistant to D. L. Brown, president of the United Aircraft Corporation, and then became vice-president of the corporation and general manager of the Pratt & Whitney Aircraft Division.

IT is probably generally agreed that there is no large industry that makes, in quantity, such a precise mechanism as the aircraft engine industry. The products of this industry have been made possible primarily by engineering research on the part of engine designers; but the execution in metal of the ideas of the designing engineer have been made possible by three coordinated factors—precision machine tools, careful training of the workmen, and a most rigid inspection system. The exacting requirements in the aircraft engine field are not duplicated in any other quantity-production industry.

THIS being the case, it is obvious that the requirements the aircraft engine builder places upon machine tools are more exacting than those of other industries. What would be amply good elsewhere may be considered crude in aircraft manufacture. Limits of 0.0001 inch are commonplace in this field. In the reduction gear, for example, there are six little pinions less than 3 inches in diameter, which together transmit 1200 horsepower; they are ground to limits of tooth form and bore dimensions expressed in ten-thousandths rather than thousandths of an inch—that is, limits such as gage-makers used to work to only a few years ago. These pinions must not only themselves be accurate, but they must be accurately placed so that each will take its proportionate share of the load. Precision in manufacture has now reached the point where these parts can be made to such a high degree of accuracy that complete equality of load distribution is secured. Accomplishments such as this, modern machine tools make possible.

THE machine tools used in this industry must not only be accurate, but capable of removing a great deal of metal rapidly. For

example, a cylinder barrel forging weighs 45 pounds. When completely machined, it weighs only 7.33 pounds. The weight of the finished cylinder barrel conveys an idea of the amount of metal that must, in many cases, be removed, in order to produce the complex designs called for by the unusual performance required of airplane engines.

IN the gear reduction housing, the splines are broached. The broaches used must be accurate to a tolerance of 0.0002 inch in tooth width. Here, again, it may be recollected that it is not long ago that the gages for work of this character were not so accurate as this.

THESE few examples illustrate what the modern machine tool is capable of doing. The aircraft industry requires machine tools that are sturdy enough to cut materials of great hardness and toughness at high cutting speeds. Even for ferrous alloys in the heat-treated condition, with Brinell hardness up to 300 or more, no cutting speed of less than 40 feet a minute is likely to be used; and, with carbide tools, these hard and tough ferrous materials are machined at speeds as high as 200 feet a minute; and non-ferrous alloys at speeds up to 600 or 700 feet a minute.

NEVERTHELESS, it is possible to conceive of improvements in machine tools that would make them still better suited to the exacting needs of the aircraft engine industry. Provision should always be made for a sufficient amount of cutting fluid to prevent undue heating. In the Pratt & Whitney engine plant, grinding machines are run idle during the noon hour, in order to keep the bearings at constant temperatures. There are instances where machines, while starting up, have to be run for from thirty to forty-five minutes before they are put to work. It is believed that most of the difficulty is due to a change in temperature in the lubricants. Obviously, the greater the thermal capacity of the lubricating system, the less difficulty would be experienced from this cause. Greater capacity of the coolant fluid tank and system is a desirable and needed improvement.

ANOTHER problem—an old one, not new to the aircraft industry—is that of chip disposal. Better facilities for removing chips in production machinery are highly desirable. Sometimes, also, there is not enough capacity for the drainage from the so-called "pan" back to the coolant tank. Larger pipes are desirable.

HYDRAULIC systems frequently cause trouble. There are leaky pumps and air pockets. Sometimes it is necessary to run a machine for thirty minutes to stabilize the hydraulic system. Improvements, however, are constantly being made and some of these difficulties will doubtless soon be overcome. Improvements are desirable in multiple V-belt drives, especially for grinding machines. The V-belts should bind uniformly in all the grooves; otherwise the effects will show on the ground part. On many machine tools, the addition of shelves for gages, tools, and work would be an improvement. Actually, some of the modern machine tool designs are so beautifully streamlined that unless shelves are provided, there is no place even for a gage.

AFTER having mentioned these desirable improvements, I would like to review briefly the achievements of modern machine tools. Machines have been developed that utilize the full cutting ability of modern cutting tools and great improvements have been made in providing ease of changing speeds and feeds. Hardened ways have contributed a great deal to machine tool life. Improved gearing has eliminated chatter marks. Electrical systems have been highly developed from an operating and trouble-free maintenance point of view. Clutches have been greatly improved.

IN conclusion, it may well be pointed out that there are only a few parts of the aircraft engine that are selectively assembled. Modern machine tools permit most parts to be made so that they are truly interchangeable. No so-called hand work is required. That means that engines can be serviced anywhere in the world with parts supplied by the manufacturer. This, in itself, I consider the highest tribute to the machine tool industry.

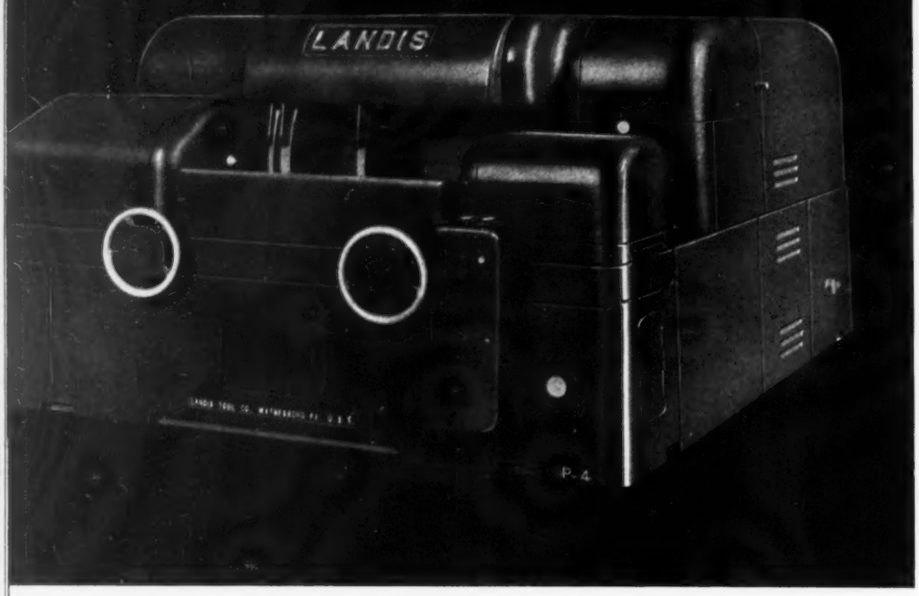


Fig. 1. Landis Hydraulic Grinder for the Rapid Multiple-wheel Grinding of Surfaces Widely Spaced on Shafts

Latest Types of Landis Grinding Machines

Three completely new grinding machines have been brought out by the Landis Tool Co., Waynesboro, Pa., including the 16- by 40-inch Type IW hydraulic grinder, the No. 1 Race-A-Way grinder, and a radial cam grinder.

The Type IW hydraulic grinder (Fig. 1) is designed for the rapid multiple-wheel grinding of parts on which the wide spacing of the surfaces to be ground necessitates mounting the grinding wheels between spindle bearings. A typical operation of this sort is the grinding of main bearings and outside diameters on the flange of crankshafts.

The operation of the machine is automatic after the grinding cycle has been started. One of the major features is the work loading and unloading device at the front, which minimizes the work of the operator. The mechanism is counterbalanced, and as soon as a shaft has been placed on it, the operator simply gives the shaft a light push to start the movement of the loading device. The shaft is carried down between the work-centers, at which position the footstock center automatically advances and picks it up.

With the advance of the footstock center, a lateral locator swings down from the front of the wheel-base into the operative position. The operator next checks an indicator, bumps the table traverse handwheel until the locator reads zero, and depresses the cycle starting button. The locator then returns to its inoperative position, work rotation starts, and the wheel-base feeds in to grind the work down to size, at which point an electric timer comes into action for controlling a fixed spark-out period. Following the spark-out, the wheel-base moves rapidly to its back position, work rotation stops, the footstock center recedes, and the shaft drops into the loading device, which carries it upward to the front of the machine for unloading.

The No. 1 Race-A-Way grinder (Fig. 2) is intended for the production grinding of very small ball-bearing raceways, the capacity ranging up to and including No. 204 bearings. Larger sizes of raceways can be handled by the No. 2 grinder of this type, which was described in October, 1938, MACHINERY.

One of the outstanding features of the No. 1 machine is an automatic sizing device, which controls the size of each race by compensating automatically for any slight error in the race previously ground, there being no room for a sizing finger in the race during the grinding operation. This device compensates for variation in the amount of stock to be removed, for bearing distortion resulting from heat-treatment, for variation in the groove concentricity relative to the outside diameter, for variation in the grinding wheels, and for variation in grinding efficiency from the full-size wheel down to the minimum size.

Fig. 2. Landis Race-A-Way Grinder Designed for Very Small Ball-bearing Raceways

The sizing device, in combination with an electric timing device, enables the machine to actually perform three operations during a single grinding cycle. The race is rough-ground at a normal feed up to the point where only a small amount of stock is left to be removed. Then the sizing device brings the slow grinding feed into play until the race is finish-ground. With the work practically to size, the slow feed movement stops, work-head oscillation stops with the work-head centered, the electric timing device is engaged, and for a fixed but very brief period, the wheel sparks out until the work reaches the exact size. The latter of the three operations is required on super-precision races in order to remove the slight spiral caused by the oscillating motion of the work-head during the previous operation. The grinding wheel runs at 50,000 R.P.M.

The radial cam grinder (Fig. 3) has been developed for one of the most exacting of present-day machining operations, that is, the grinding of radial airplane engine cams. Angular type cams can be ground, as well as the conventional straight-face cams and numerous other of the larger loose cams, such

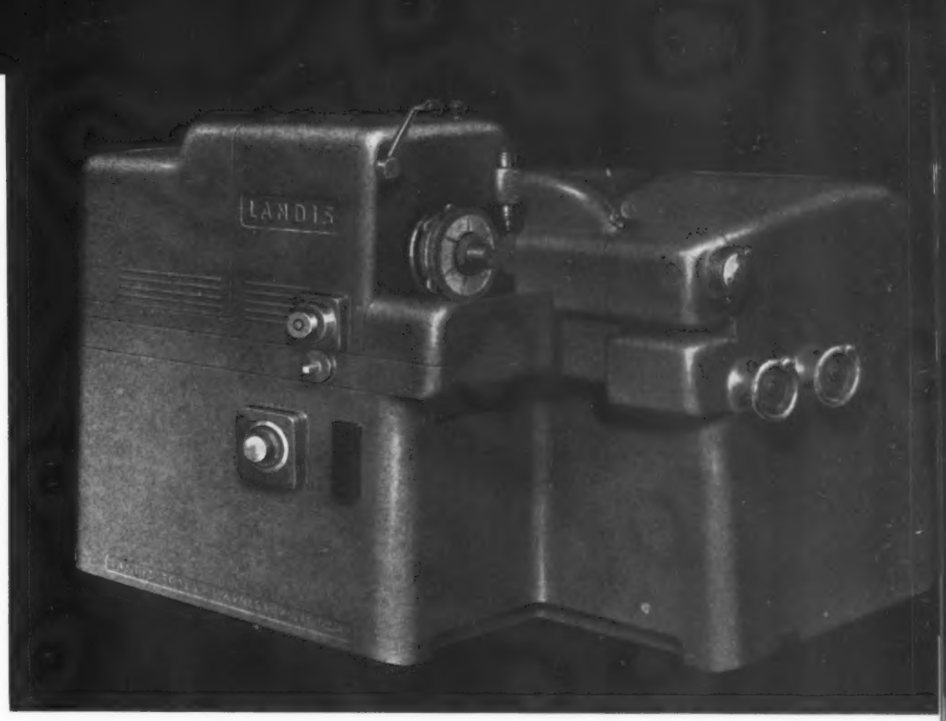


Fig. 3. Landis Machine Designed for Grinding the Intake and Exhaust Cams of Radial Airplane Engines

as those used on Diesel engines. The machine has a swing of 18 inches.

The headstock spindle assembly is carried by a swinging bracket mounted on tapered roller bearings. As the spindle assembly revolves, the master cam mounted on it is in contact with a roller at the rear of the headstock. This roller imparts a swinging motion to the work-spindle assembly. The bracket can be locked for cylindrical grinding.

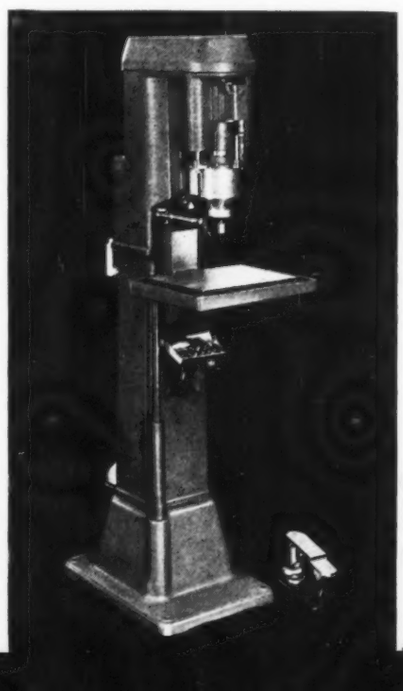
Addition to Haskins Line of Air-Controlled Tapping Machines

One of the latest products of the R. G. Haskins Co., 617 S. California Ave., Chicago, Ill., is an air-controlled tapping machine known as the No. 2-C, which has a capacity of from No. 8 to 5/16 inch diameter in steel and 3/8 inch in brass. In this machine, the motor drives the tap through a V-belt and multi-speed pulleys.

Compressed air, controlled by an automatic air valve, furnishes the pressure required for both the tapping and reversing strokes of the tap head. The automatic valve also controls the speed with which the tap is fed into and reversed out of the work. A foot-pedal enables the operator to start or stop the tapping cycle, which is controlled by the automatic valve. The machine operates in continuous cycles as long as the air valve is held open. It can also be used intermittently, by operating the foot-pedal and then releasing it, to produce one complete cycle.

This machine lends itself to feeding parts into a simple holding or magazine fixture. It is also adapted to the use of hopper or dial feed, or to specially designed fixtures.

Haskins Air-controlled Tapping Machine — Capacity, up to 5/16 Inch in Steel and 3/8 Inch in Brass

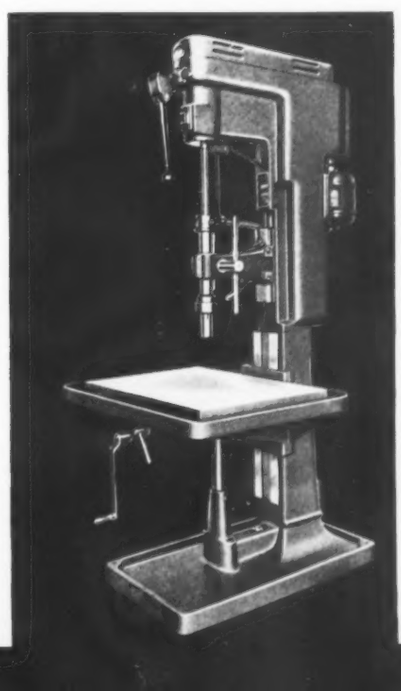


Avey Drilling Machines

Several new models of single- and multiple-spindle drilling machines are being introduced by the Avey Drilling Machine Co., Cincinnati, Ohio. The machine illustrated is equipped with a belted motor drive. It has an unusually wide range of spindle speeds and an extra large table which adapts it especially for tool-room and die-shop use.

One of the other new models is a Type MA-8 machine, designed for small-hole drilling at speeds from 1200 to 12,000 R.P.M. It is equipped with a super-sensitive tapping attachment. Other new developments include cam-feed drilling and tapping units, Motor-Avey drilling and tapping units, and an "Aveydraulic" deep-hole drilling machine.

Drilling Machine Equipped with a Belted Motor Drive Built by the Avey Drilling Machine Co.



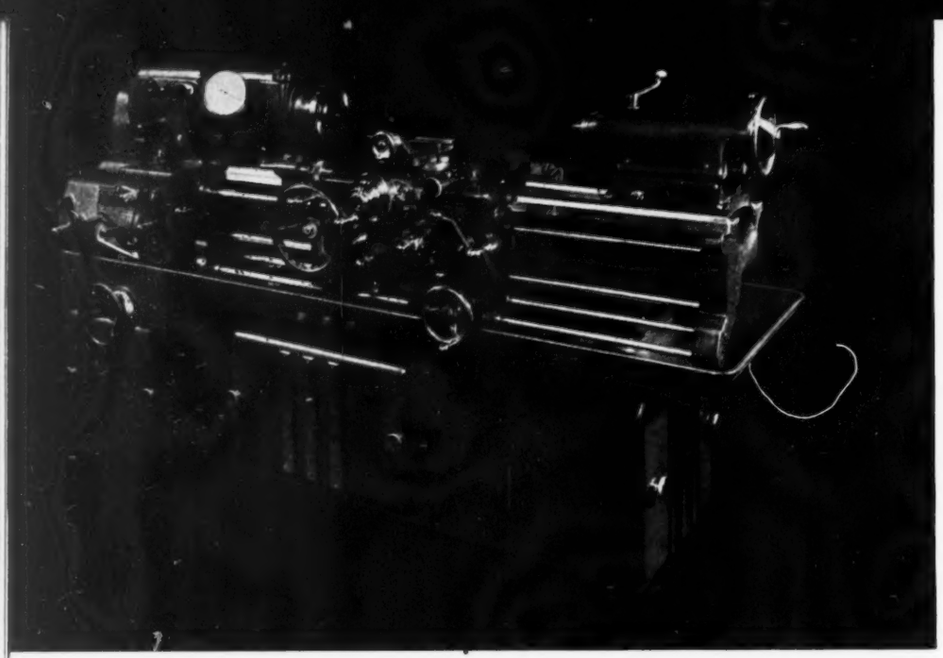


Fig. 1. (Left) Monarch 12- by 30-inch Lathe with Alternating-current, Adjustable-speed Drive

Fig. 2. (Below) Toolmaker's Lathe with Lead-screw Variator for Chasing Accurate Threads

New Equipment Developed by the Monarch Machine Tool Co.

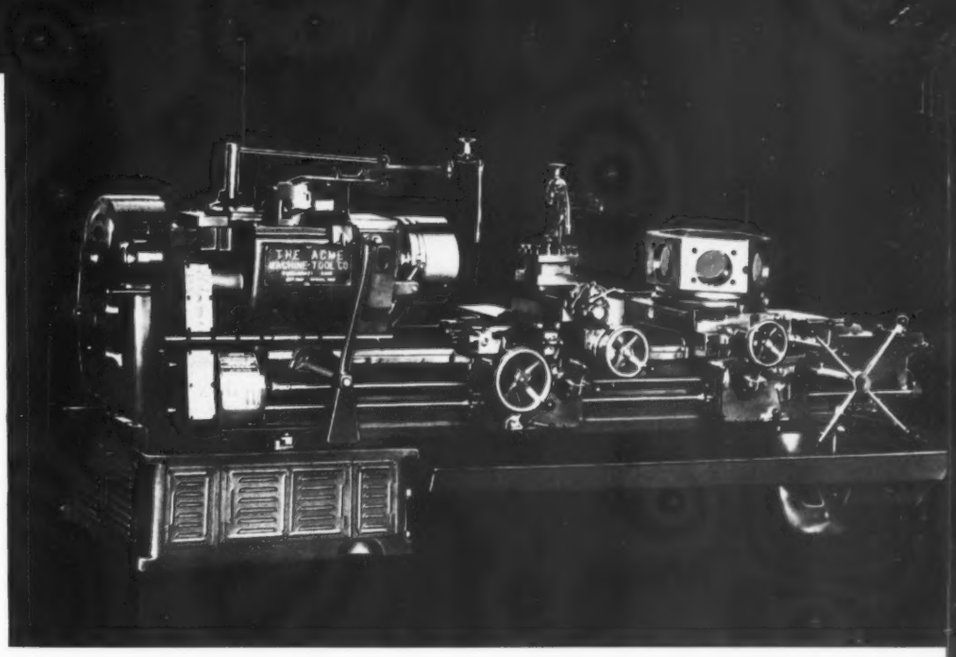
Recent developments of the Monarch Machine Tool Co., Sidney, Ohio, include a new 12- by 30-inch lathe, Fig. 1; a Monarch-Keller controlled lathe with a Kelley shape-turning device, Fig. 3; and a lead-screw variator for chasing accurate threads, Fig. 2.

The 12- by 30-inch machine has a new type all-electric, alternating-current, adjustable-speed drive, employing a principle of speed control heretofore confined to large drives. The 100 to 1 spindle speed power unit is entirely self-contained, being mounted inside the cabinet base. The drive is through a new type of flat belt. Two ranges of spindle speeds from 15 to 1500 R.P.M. are provided by means of a back-geared unit on the spindle. This range can be varied to suit the requirements.

The Monarch-Keller controlled lathe equipped with a Kelley shape-turning device is intended for turning, boring or facing dies, molds and similar work to any irregular contour or shape within the range of the cutter used. A thin metal templet is used for the Keller controls to secure the desired contour, and a circular "record" is used for the Kelley controls to obtain the desired shape in the other plane. It takes but a few minutes to mill the master "record," and this can be done on the lathe itself. As many as five hundred tool actuations can be imparted to the work at one revolution of the lathe spindle. The drive from the infinitely variable speed power unit to the spindle is through multiple V-belts.

The lead-screw variator is shown in Fig. 2 applied to a 14-inch toolmaker's lathe, but it can be applied to any size Monarch lathe. Its operation is simple. The screw to be threaded is rough-chased in the regular way, a few thousandths of an inch being left for finishing. An accuracy reading is then made, with the work in the lathe, by means of a visual gage that measures errors to 0.00001 inch, and the lead error in each inch of the semi-finished screw is recorded. This error is removed in the finish-chasing operation by manually moving the lathe lead-screw laterally by means of the variator to compensate for the lead errors recorded in the semi-finished screw.

Fig. 3. Monarch-Keller Controlled Lathe, with Kelley Shape-turning Device



Acme Heavy-duty Universal Turret Lathe Equipped with a Hydro Electric Duplicator for Contour Boring and Turning Operations

Acme Heavy-Duty Turret Lathes

Two new machines have recently been developed and placed on the market by the Acme Machine Tool Co., 4955 Spring Grove Ave., Cincinnati, Ohio. One of these is a 3S heavy-duty universal turret lathe, and the other a 5R ram type universal turret lathe.

The 3S machine is shown in the illustration equipped with a hydro-electric duplicator. This is an attachment designed for contour boring and turning. It is believed to be the first attachment of this kind ever to be applied to a turret lathe. In addition to performing contour boring and turning, the machine can be tooled for performing regular operations, such as straight turning and boring, facing and threading—all in the same chucking as for contour boring and turning.

This machine is of new design throughout. Among the features are greater distance between the vees, a pyramid type headstock with the motor in the base, a new feed selector, and positive lubrication. In general, the object of the design has been to lessen the burden placed on the operator and to increase production.

The 5R machine is equipped with a new twelve-speed headstock for which an electrically operated speed selector is provided. Several other features making for convenience of operation and increase in production have been incorporated.

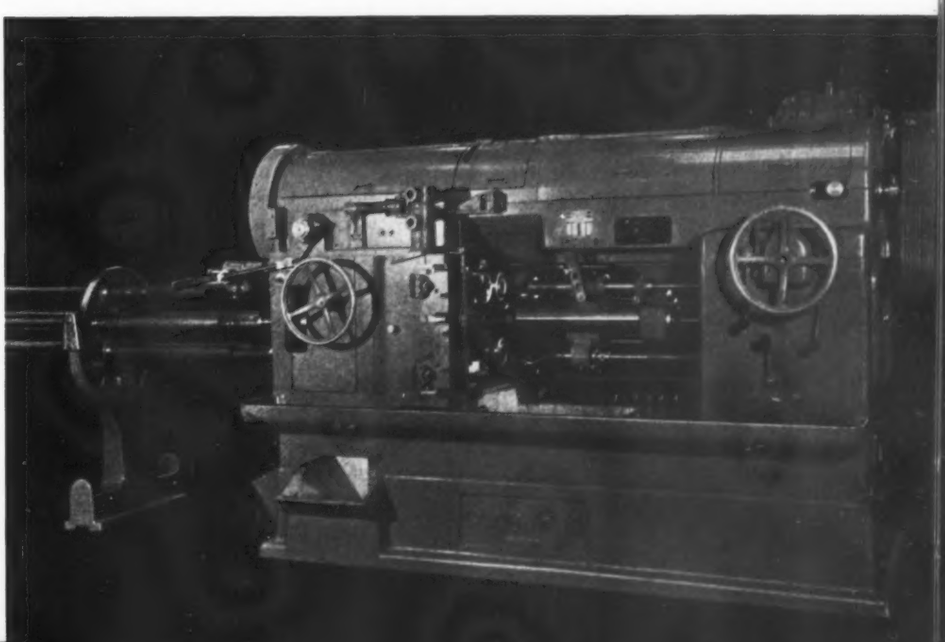
Improved Six-Spindle Conomatic Screw Machines

The Cone Automatic Machine Co., Inc., Windsor, Vt., has announced the improved six-spindle Conomatic screw machine here illustrated, on which several improvements have been made since this machine was originally introduced (see MACHINERY, October, 1938, page 132). The chief improvement consists in the division of the cross-slides. The upper front slide is independently operated by its own cam, and is generally used for cutting off the work. The lower front slide provides for two forming tools. It is of massive construction, so that very heavy forming cuts can be taken.

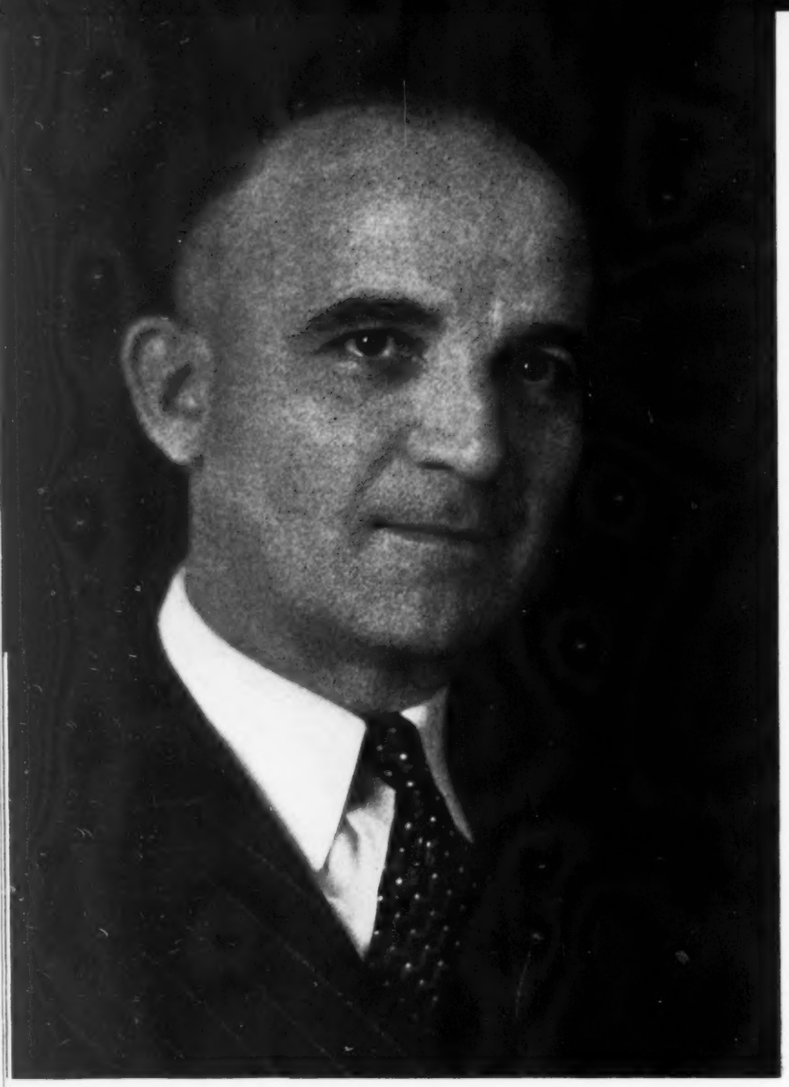
Similar cross-slides are provided for the three rear spindle positions. The lower rear cross-slide provides two positions for finish-forming, and the upper rear cross-slide is independently operated and can be used for accurate finishing to close tolerances, or it can be used for special tools as, for example, knurling tools.

Each cross-slide carries independent positive stops, insuring exact duplication of work on high-production runs. These positive stops are adjustable for each spindle position and are positioned automatically by the indexing of the spindle-carrier.

The six-spindle Conomatic is built in six sizes, 1 1/4, 1 1/2, 1 7/8, 2 1/4, 2 5/8, and 3 1/2 inches.



Cone Six-spindle Conomatic Screw Machine with Improved Cross-slides



WILLIAM F. PIOCH

Need for

By WILLIAM F. PIOCH
Chief of Mechanical Design
Ford Motor Co., Dearborn, Mich.

William F. Pioch, chief of mechanical design of the River Rouge plant of the Ford Motor Co. at Dearborn, Mich., served his apprenticeship in the shop and drafting-room of the Industrial Works, Bay City, Mich. After having completed his apprenticeship, he went to Detroit and worked in a number of shops as machine and tool designer. In 1912, he became connected with the Ford organization as tool designer, also working in the tool-room as a tool- and die-maker. Due to his unusual abilities in his chosen field, he became assistant to the chief, and later chief, of mechanical design, in which position he is responsible for the methods employed in the manufacture of the Ford car and the selection of the equipment used in the application of these methods.

IN all mass-production industries, the need for inspection machines has made itself more and more felt during recent years. Not only do inspection machines that are practically automatic in their operation greatly reduce inspection costs; but, since they eliminate human judgment and human errors, they make it possible to obtain a product far more accurately inspected than is possible in any other way. Some machine tool manufacturers have produced inspection machines for products such as gears and worms; but, in general, the machine manufacturers have been reluctant to enter the field of designing and building automatic inspection machines applicable to mass production generally—as, for example, for the inspection of camshafts, crankshafts, valves, etc.—believing, apparently, that such machines are out of the province of the machine tool builder.

High-Production Inspection Machines

AS a result, some of the leading manufacturers in the mass-production industries have found it necessary to design and build their own inspection machines, many of which are of such types that a fair demand would be available for them in industry if they were built for sale. The machine tool industry has been less aggressive in the direction of inspection machines than in almost any other direction; and yet it would seem that a plant building machine tools for machining parts in mass-production industries would be the logical source to which the machine tool user would look for equipment to inspect the work performed on the machine tools themselves.

IN the past, it has always been felt that inspection was a job that had to be carried out by a human agency. It was felt that to inspect the work, a man or a woman must actually pass it through a gage and observe whether it meets the required specifications. Recently, however, some of the manufacturers in the mass-production industries, including the Ford Motor Co., have developed some unusual inspection machines that make it possible to obtain a product of greater accuracy and uniformity than has ever been possible in the past. Human judgment and power of observation are eliminated; instead, the dependability of the machine is relied upon. The touch of the machine is always the same.

IN these machines, electric contacts, the electric eye, and radio tubes are used in ingenious ways. In a camshaft inspection machine, for example, every dimension is separately measured and inspected by the machine. When the camshafts pass out of the machine, those having inaccuracies are automatically separated from those that are perfect, and the location of the inaccurate dimension is visibly marked with ink, so that the cause of the difficulty may be located.

A VALVE insert inspection machine has been designed and built which performs six separate inspections a second, and which passes upon the accuracy of 6000 valve inserts an hour. These are but examples of the types of inspection machines for which there is a demand in industry but which have not been made commercially available to the user, and which, therefore, must be developed and built by large mass-production manufacturers for their own use. Possibly in the future some machine builder will grasp the opportunity of offering such machines to the trade. The demand for some types of these machines may be limited. Nevertheless, it would be more economical to build even a small quantity to meet the requirements of a group of manufacturers in a mass-production industry than it is for a single manufacturer to design and build his own machines.

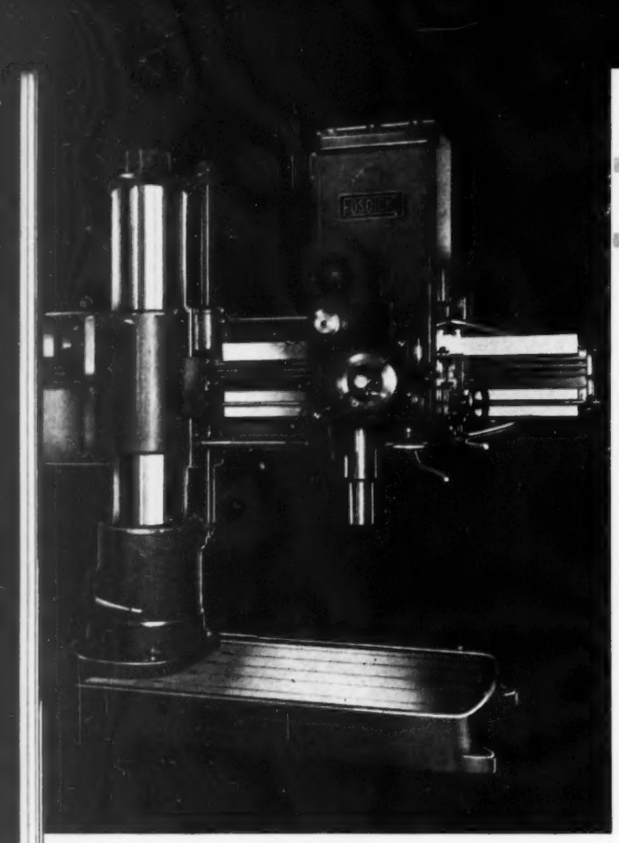


Fig. 1. (Left) Fosdick Radial Drilling Machine with Fully Hydraulic Controls

Fig. 2. (Right) Fosdick Sensitive Drilling Machine Designed to Meet the Demand for a Wide Range of Spindle Speeds

Fosdick Radial and Sensitive Drilling Machines

A radial drilling machine of entirely new design, illustrated in Fig. 1, and sensitive drilling machines of the type shown in Fig. 2 have been added to the line of the Fosdick Machine Tool Co., Cincinnati, Ohio.

Hydraulic controls were applied to radial drilling machines by this company several years ago. In the present machine, hydraulic feed and hydraulic gear shift are also added. The hydraulic controls have been improved by the use of a hydraulic motor for raising and lowering the arm. This motor is interlocked with the hydraulic arm clamp, so that it is impossible to attempt to lower or raise the arm while it is clamped. The clamping of the outer column to the inner column is done hydraulically and is controlled from the head.

Thirty-six spindle speeds are obtained through a hydraulic shifting mechanism. The feed can be changed while the machine is in operation without damage to the gears or any of the mechanism.

To meet the demand for a wider range of spindle speeds, the company's BM type sensitive drilling machine has been redesigned to provide six, nine, twelve or eighteen speeds. Various speed ranges, from as low as 50 to as high as 5000 R.P.M. are obtained in the new design. The standard machine can be furnished with either six or nine speeds in a range of either 225 to 1800, or 110 to 1800 R.P.M., using a single-speed motor. A two-speed motor can also be used, which will give a still wider range of speeds. The control for either size motor is mounted in a sealed casing back of the lower pedestal and a push-button is mounted in the front of the top bracket, directly in front of the operator's position.

Gallmeyer & Livingston Production and Tool-Room Surface Grinders

The large hydraulic-feed surface grinder shown in Fig. 1 has been developed by the Gallmeyer & Livingston Co., 305 Straight Ave., S.W., Grand Rapids, Mich., especially for precision surface grinding on a production basis. Longitudinal table speeds up to a maximum of 150 feet per minute are obtainable through a Vickers tandem pump. The base of the machine, which houses the hydraulic unit and the oil reservoir, is twice the length of the working surface of the table, so that no part of the working surface overhangs the base of the machine under normal working conditions.

A 25-H.P. motor mounted directly

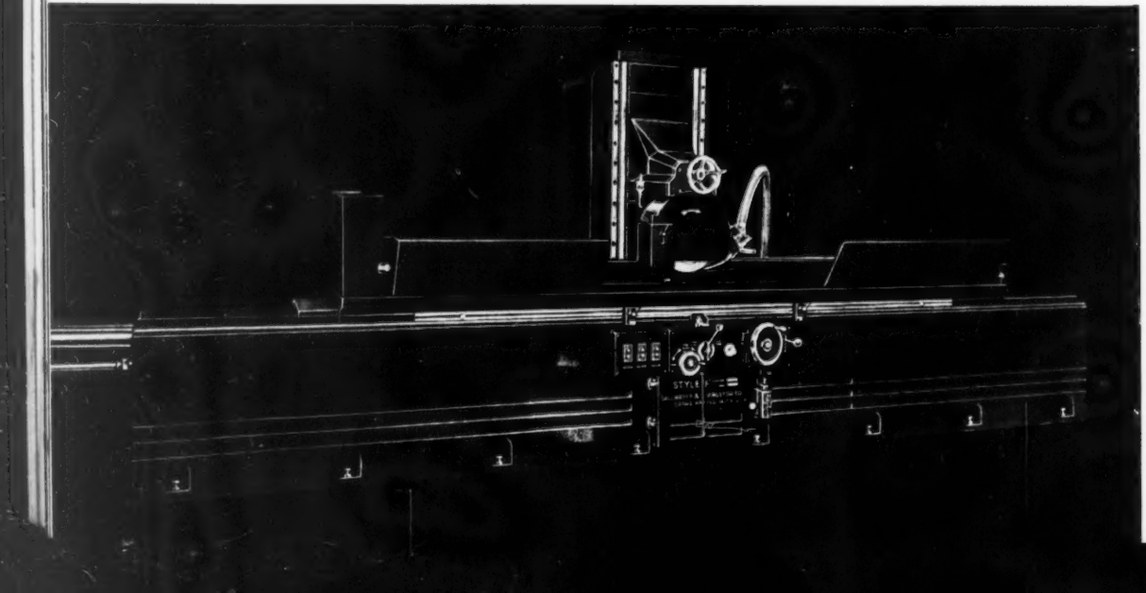


Fig. 1. Gallmeyer & Livingston Production Type Hydraulic-feed Surface Grinder which is Equipped with a Tandem Pump for Operation at Table Speeds up to 150 Feet per Minute

Fig. 1. (Left) Cincinnati Small Vertical Milling Machine for Producing Firearm, Sewing-machine, Refrigerator and Similar Parts

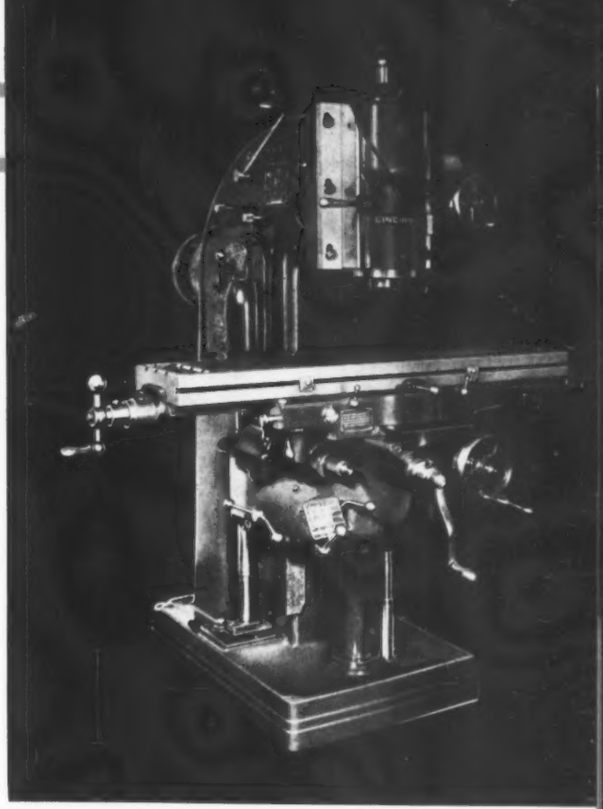


Fig. 2. (Right) Another Vertical Milling Machine of Simplified Design Added to the Cincinnati Line

on the grinding wheel spindle provides ample power for production work. The grinding wheel can be cross-fed either through a handwheel or an automatic hydraulic arrangement. With the hydraulic feed, the amount of transverse movement at each reciprocation of the table is adjustable to a maximum of 2 inches. There is also a continuous cross-feed for dressing the grinding wheel while the machine table remains stationary.

Power elevation of the head slide is controllable during actual grinding through a handwheel graduated to 0.0001 inch. Machines of this type can be built with a table working surface ranging from 12 by 36 inches to 30 by 144 inches.

Another new machine brought out by the company is the No. 55 precision tool-room machine illustrated in Fig. 2. Table speeds up to 125 feet per minute are obtainable on this machine, which is built around a one-piece column and base casting that weighs over 4000 pounds. This machine is also provided with a hydraulically actuated cross-feed that can be set to operate at each reversal of the table or at one end only of the stroke. Micrometer readings are obtainable from 0.0001-inch graduations located over 1/8 inch apart. This machine is built in a series of sizes in which the table working surfaces vary all the way from 6 by 18 inches up to 14 by 48 inches.

New Milling Machines Brought Out by the Cincinnati Milling Machine Co.

A small vertical type milling machine particularly suitable for either rapid-production or job-lot production of small parts for firearms, sewing machines, refrigerators, cash registers, business machines, and similar products, has been added to the varied line of machines built by the Cincinnati Milling Machine Co., Cincinnati, Ohio.

This No. 0-8 machine, shown in Fig. 1, is pleasingly modern in appearance, with the bed and column cast of Meehanite in one piece. The machine is mounted on a cabinet base to provide a convenient table working height. It is equipped with a 1-H.P. motor for the spindle drive, and a 1/4-H.P. motor for the table drive.

The standard table working cycle includes a power rapid advance, power feed, reverse movement actuated through a directional control lever, and a power rapid return, all of these movements being engaged by hand. Handwheels graduated in thousandths of an inch, located at each end of the table, facilitate accurate movement of the table. Another handwheel similarly graduated and located on the left-hand side of the spindle head, gives an accurate control of the cross movements of the head.

Eight spindle speeds ranging from 150 to 1300 R.P.M. are readily selected through interchangeable four-step pulleys on the spindle drive-shaft and on the motor drive-shaft. Two series of eight table feeds each are available. The low series ranges from 1/2 inch to 5 1/8 inches per minute, and the high series from 1 inch to 10 1/4 inches per minute.

The No. 2-L vertical milling machine of the construction illustrated in Fig. 2 is another new de-

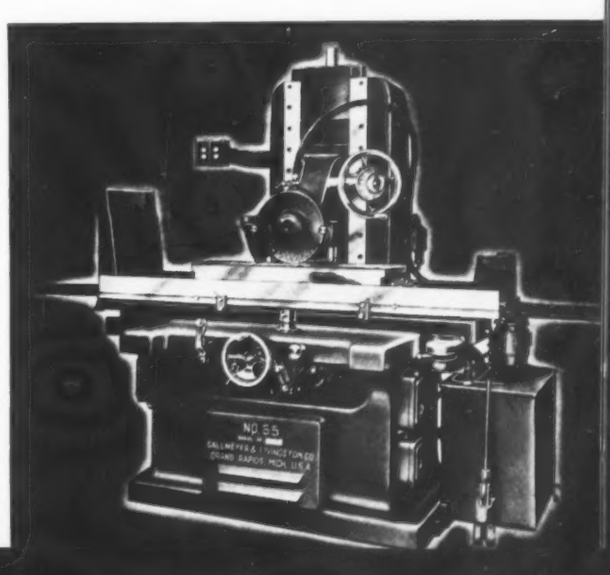


Fig. 2. Gallmeyer & Livingston Precision Tool-room Surface Grinder which can be Operated at Table Speeds up to 125 Feet per Minute

velopment of the same company. These machines have been designed with simplicity, sensitivity, and rigidity in view. They are intended for use in both tool-rooms and manufacturing departments.

Without moving from his normal position directly in front of the machine and work, the operator can engage the power rapid traverse; change speeds and feeds; start and stop the spindle; operate the hand-feed to the vertical head; engage cross, vertical, and longitudinal power feeds; and make hand-adjustments to the table, saddle, knee, and work-holding fixtures.

A four-position turret stop equipped with a dial indicator for accurate step milling operations can be supplied. This attachment provides a quick method of obtaining accurate vertical dimensions between two, three, or four milled surfaces.

The table of the No. 2-L machine has a working surface of 44 1/2 by 14 7/8 inches and the longitudinal range is 28 inches. The drive is through a 3-H.P. flange-mounted motor.

Fig. 1. Double-spindle Disk Grinder Built by the Hanchett Mfg. Company

Hanchett Disk, Surface, and Face and Knife Grinders

Several new and redesigned grinding machines are being built by the Hanchett Mfg. Co., Big Rapids, Mich. One of the new machines is a double-spindle disk grinder (Fig. 1), equipped with 14-inch disk type wheels, each being driven by a 3-H.P. motor. The machine is provided with rotary work-fixtures, and is intended for production work on small parts having two opposite parallel surfaces to be finished.

A newly redesigned reciprocating vertical-spindle surface grinding machine is shown in Fig. 2. This machine has a 14-inch cylinder grinding wheel driven by a 25-H.P. motor. The table is 13 inches wide by 50 inches long. This type of grinder is suitable both for production and tool-room work. The automatic sizing attachment is particularly advantageous on various types of production work.

Another machine announced is a newly redesigned face and knife grinder with horizontal spindle (Fig. 3). This machine is provided with a segmental type, 36-inch diameter grinding wheel driven by a 50-H.P. motor. It has a table 36 inches wide by 86 inches long. This type of machine is intended chiefly for straight manufacturing operations, often doing work formerly milled or planed. It is frequently used in railroad shops for grinding guide bars and miscellaneous parts, and in steel mills for grinding shear blades and knives and work of similar character.

The company has also just introduced a new vertical-spindle disk grinder using a 53-inch diameter wheel, driven by a 30-H.P. motor. The drive is by V-belts from a vertical motor mounted at the rear. The work to be ground is laid on the top of the revolving disk and prevented from traveling with it by means of

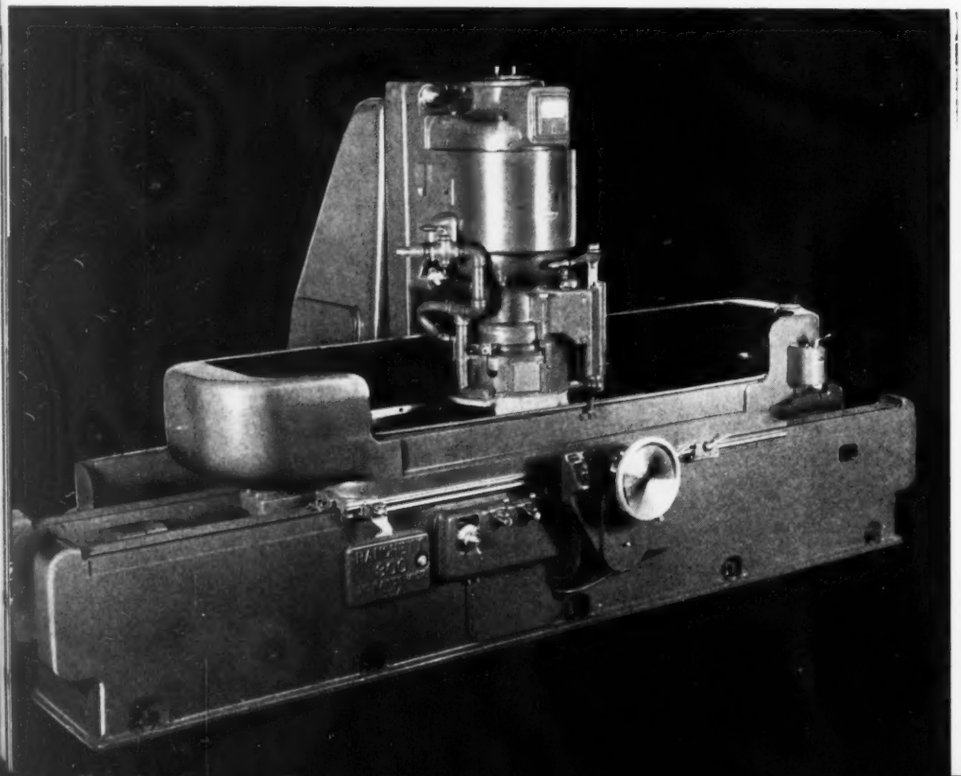


Fig. 2. Hanchett Reciprocating Vertical-spindle Surface Grinder for Production and Tool-room Work

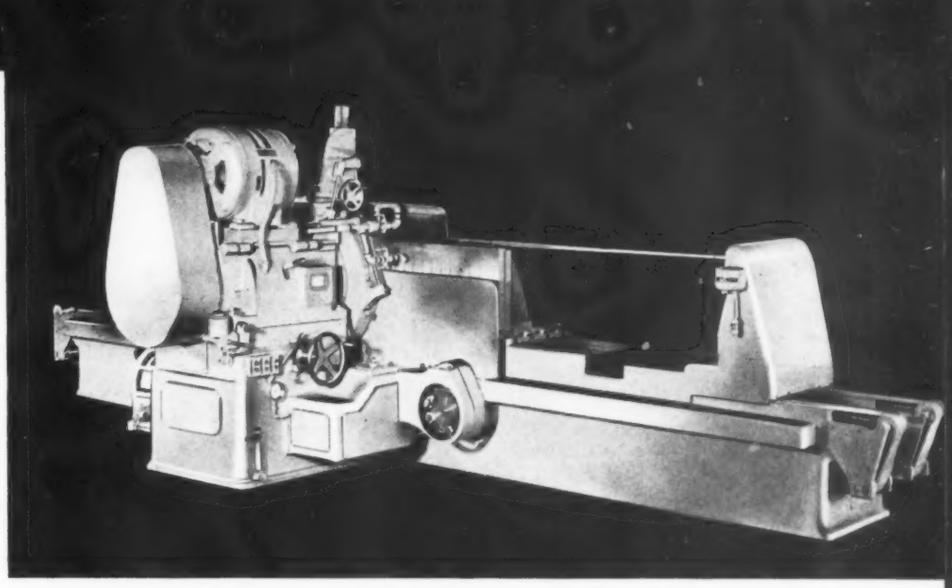


Fig. 3. Hanchett Face and Knife Grinder, for Straight Manufacturing, and for Railroad Shop and Steel Mill Use

stops. This machine is intended to surface-grind parts that are of rather large proportions and yet have relatively small areas to be ground. Such work includes large gear covers, stove doors, etc.

Cincinnati "Hypro" Vertical Boring Mill

A vertical boring mill just developed by the Cincinnati Planer Co., Cincinnati, Ohio, is equipped with two rail-heads and one side-head, has a total swing of 6 feet 4 inches, and is 60 inches high under the tool-holders.

Each head is provided with twelve mechanical feed changes ranging from 1/96 inch to 0.8 inch. All of the three heads have power rapid traverse, the rate of traverse being approximately 7 feet per minute. A separate feed-box is provided for each head, with complete feed, rapid traverse, and reversing mechanism. The side-head is equipped with a support of unique design, the saddle being supported on the outside of the housing, which distributes the stresses over the entire housing. All heads and rams are provided with centralized automatic lubrication from a small pump on each head.

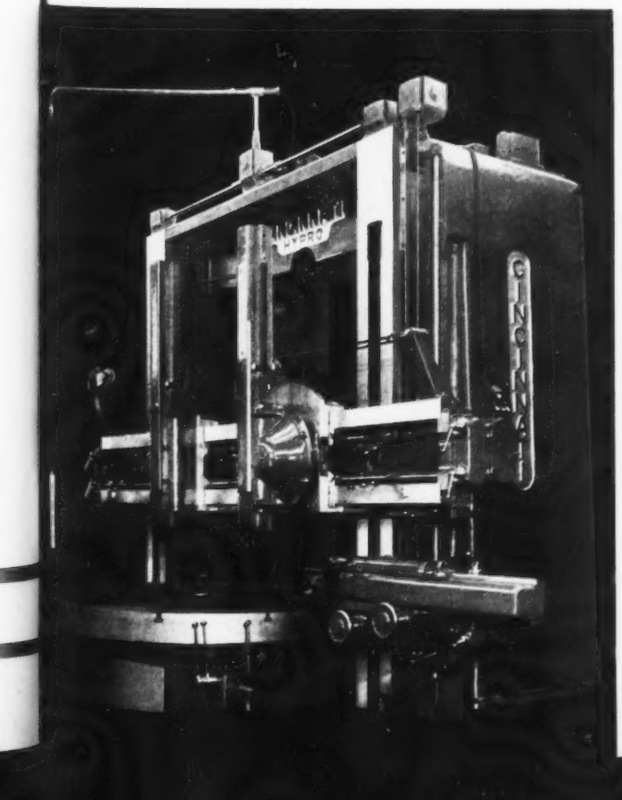
Individual motors for each unit eliminate many mechanical features. There is a 30-H.P. variable-speed motor for the main drive, with four mechanical speed changes, providing a range of table speeds of from 1.3 to 50 R.P.M. A 5-H.P. motor is used for elevating the rail, and 2-H.P. motors are provided for each of the two rail-heads and the side-head for rapid traversing. In addition, there is a 1-H.P. motor for the lubricating pump and a 1-H.P. motor for the coolant pump. All controls for the machine are mounted in one floor cabinet.

Positive pressure lubrication is provided for the table track, transmission gears, and bearings. The main drive motor is interlocked with the oil-pump motor, so that the table cannot be run without the required lubricant pressure. The machine weighs approximately 69,000 pounds.

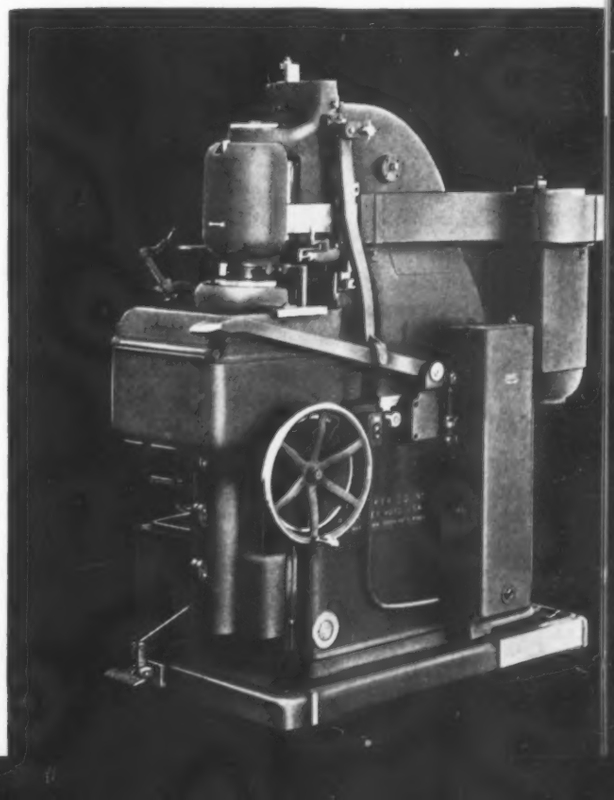
Walker Single-Stroke Surface Grinder

A radical change in construction is in evidence in the single-stroke surface grinding machine which is being built by the O. S. Walker Co., Inc., Worcester, Mass. This machine has been redesigned and improved in several features. The wheel-spindle is driven by a 10-H.P. motor, vertically mounted on the back of the column. The power is transmitted through a horizontal belt with a "binder" pulley. A separate 1 1/2-H.P. end-shield motor at the rear drives the table.

Six table speeds are available; the starting and stopping of the table are automatically controlled by raising or lowering the wheel-head, as are also the magnetizing and demagnetizing of the magnetic chuck. A foot-brake is provided for quickly stopping the table. Among the improved features should also be mentioned a wheel-head locking device, and provision for adjusting the upper portion of the column for grinding saws, cutters, etc., having hubs up to 6 inches in diameter.



(Left) Cincinnati 6-foot "Hypro" Vertical Boring Mill Having Two Rail-heads and One Side-head



(Right) Walker Single-stroke Surface Grinder, Completely Redesigned

Spending Millions to Re-Equip

THE purchase of $6,000,000 worth of machine tools for modernizing the manufacturing arsenals of the United States Army will enable substantial strides to be made in what is hoped to be the beginning of a program of complete rehabilitation of ordnance production facilities. This substantial sum of money was appropriated by Congress for expenditure during the present fiscal year. It affords a most desirable opportunity, but also carries considerable responsibility if the money is to be wisely used.

AUTHORITY for the selection of new manufacturing equipment has been delegated for years by the Ordnance Department to the individual arsenals, on the principle that the arsenal officers and civilian executives are best qualified to know what types of machine tools will meet their production requirements most satisfactorily. The arsenal authorities are responsible for turning out their products within specified dates and costs, and it is only fair that they should have freedom of action in selecting equipment for doing the work in what they consider to be the most efficient manner.

THIS decentralized method of purchasing machine tools and accessories facilitates the solution of special production problems, because it fosters consultation between the arsenal authorities and prospective suppliers of the desired equipment who are in a position to draw upon their experience in solving manufacturing problems of private industries. Incidentally, constructive suggestions from machinery builders and other engineers as to how arsenal methods may be improved are always sought and welcomed.

WHEN an arsenal has decided upon the purchase of a machine to meet a certain need, descriptive specifications are prepared by the arsenal authorities. Circular advertisements containing the specifications are then printed and mailed to prospective suppliers of the equipment with a view to obtaining bids. These advertisements are available to any interested concern.

THE legal statute governing the procurement of supplies by government agencies necessitates that awards for machine tools be made to the lowest responsible bidder complying with the conditions of the advertisement, provided "(1) his bid is reasonable, and (2) it is to the interest of the United States to accept it." A responsible bidder is one who (a) qualifies as such under the laws and lawful regulations governing the purchase of the articles in question; (b) has complied with all the requirements of the invitation for bids; (c) is a manufacturer of or a regular dealer in the articles which he offers to supply; (d) is in a position to perform the contract, and whose previous record does not indicate lack of responsibility.

AWARDS do not necessarily have to be made solely on price. If a machine tool incorporates some feature or can be provided with attachments that would be distinctly advantageous to an arsenal production problem, specifications can be written to require that feature on a new machine. The law does not prohibit the writing of specifications sufficiently restrictive to enable arsenals to obtain exactly the type of machine required, but the specifications must not be so restricted as to exclude any concern that may be in a position to make a bona fide bid on a machine suitable for the service intended.

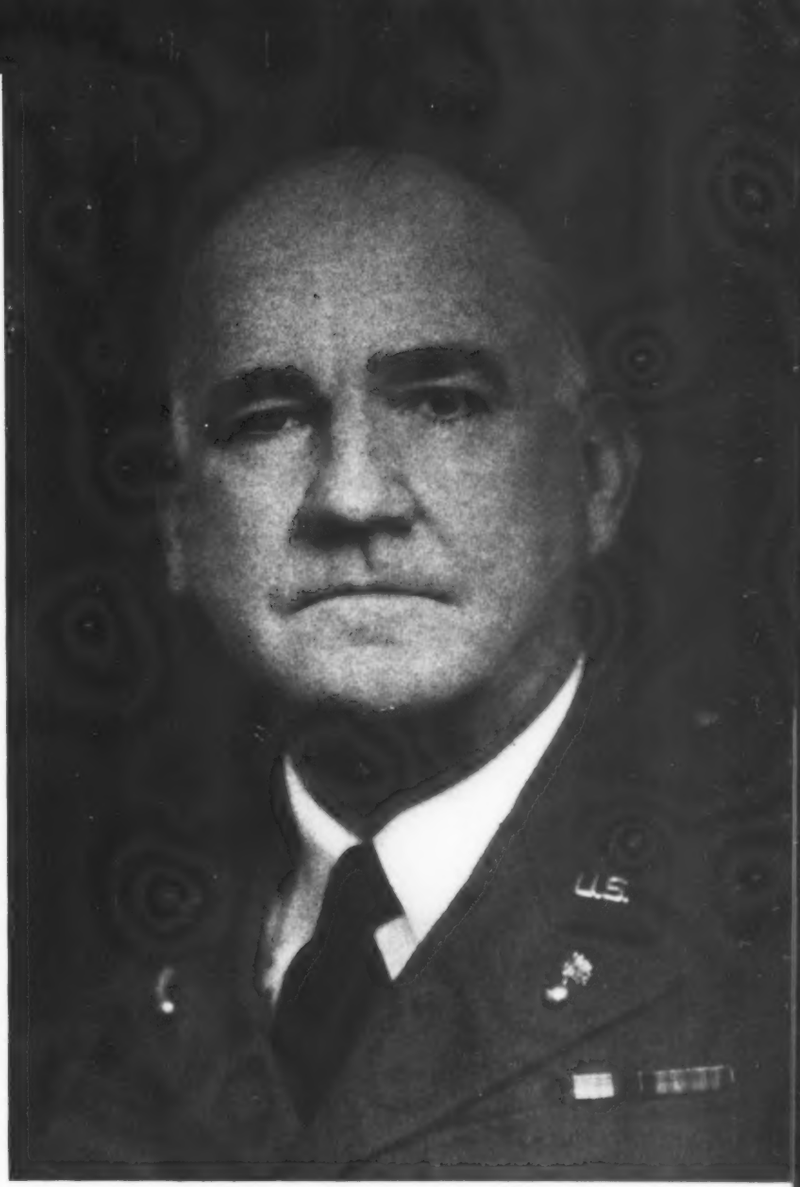
IN any case where the operation requires a type of machine which can be obtained from one source only, the arsenal is not required to advertise for bids, and if equipment or supplies up to a value of only $500 are contemplated, it is not required that formal bids be invited. When the contemplated expenditure is $500 or less, the arsenal meets legal requirements by obtaining bids informally, by letter or telephone, but even then quotations must be obtained from two or more manufacturers of, or dealers in, the type of equipment required.

THE specification advertisements generally define the operation to be performed and give the general details of machine construc-

Army Arsenals

By BRIGADIER GENERAL CHARLES T. HARRIS, JR.
Chief of Industrial Service
Ordnance Department, U. S. Army

Brigadier General Charles T. Harris, Jr., was commissioned Second Lieutenant in 1907, upon graduating from the United States Military Academy. Since then he has been engaged in Ordnance activities, with the exception of about a year spent as a field officer of the Coast Artillery. In 1933, he became director of the planning branch in the office of the Assistant Secretary of War. In 1937, he was appointed Commanding Officer of Watertown Arsenal, and in the same year was returned to his former duties in the office of the Assistant Secretary of War. He was nominated by the President to be Assistant to the Chief of Ordnance, with rank of Brigadier General for a period of four years beginning September 1, 1938. General Harris was awarded the Distinguished Service Medal for his success in applying foreign methods of manufacturing powder and explosives in the United States.



BRIGADIER GENERAL CHARLES T. HARRIS, JR.

tion, accuracy requirements, and quality of workmanship. Sometimes, however, when a machine is required for a special production job, the construction details are completely omitted and even the type of machine is not specified. This procedure enables bidders to suggest machines designed along original lines, which may be far more efficient for the special operation than standard machines.

THE lowest bid as to price may be rejected if (1) the bidder does not qualify as a responsible bidder; (2) the price is unreasonable; (3) all of the essential conditions of the invitation have not been complied with; (4) no guaranty has been required and the bidder is unable to furnish satisfactory evidence that he possesses the experience and equipment to perform his contract satisfactorily in accordance with the terms; (5) the grade, quality, or kind of supplies bid upon is not that upon which bids were invited; and for other reasons.

WHENEVER it is considered advisable to reject the lowest bid (unless only a small amount is involved), the case is referred to the office of the Chief of Ordnance by the Commanding Officer of the Arsenal, in order that the legality of the rejection can be verified and that this office may be in a position to answer any inquiries from the office of the Comptroller General of the United States to whom a low bidder may protest in the event that he feels unfairly treated. Rarely, however, are such protests made with regard to machine tools, because of the efforts made to treat all bidders equitably and the practice of explaining the reasons for a rejection.

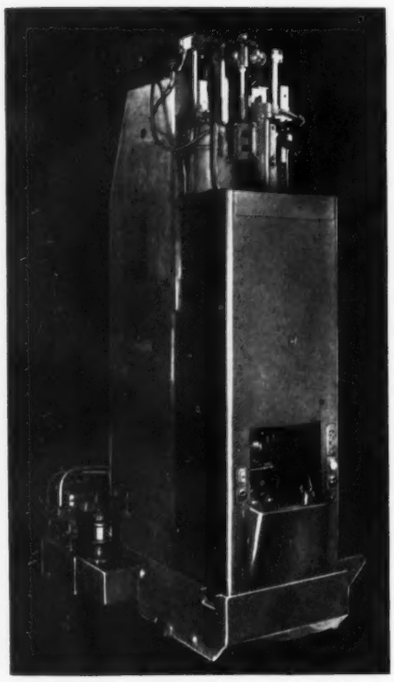


Fig. 1. (Left) Oilgear 54-inch Stroke Cyclematic Broaching Machine Applied to Broaching Splines in Universal-joint Yokes

Fig. 2. (Right) Oilgear 30-inch Stroke Pull-down Machine Applied to Broaching Keyslots in Rifle Receivers

Oilgear Broaching Machines

Four new types of broaching machines, each made in a number of sizes and offered as standard equipment, are being built by the Oilgear Co., 1315A W. Bruce St., Milwaukee, Wis. Fig. 1 shows what is known as the Type XM-20 x 54 vertical Cyclematic broaching machine equipped with tools and fixtures for broaching seventeen splines in universal-joint yokes at the rate of 440 pieces per hour, using three tools and a cutting speed of 30 feet per minute. It is one of the three sizes in which this type of machine is built, varying in capacity from 15 to 37 1/2 tons, and with broaching strokes of from 54 to 66 inches.

The machine is equipped with an Oilgear Type DX two-way variable-displacement heavy-duty radial-piston fluid power pump, arranged for direct drive and of sufficient capacity to provide variable broaching speeds up to 30 feet per minute, and return speeds up to 80 feet.

Fig. 2 shows a Type XP-10 x 30 vertical pull-down broaching machine with fixture and four tools for broaching keyslots in four rifle receivers per stroke, at the rate of 750 finished pieces an hour. This machine is one of five sizes of vertical pull-down broaching machines varying in capacity from 5 to 37 1/2

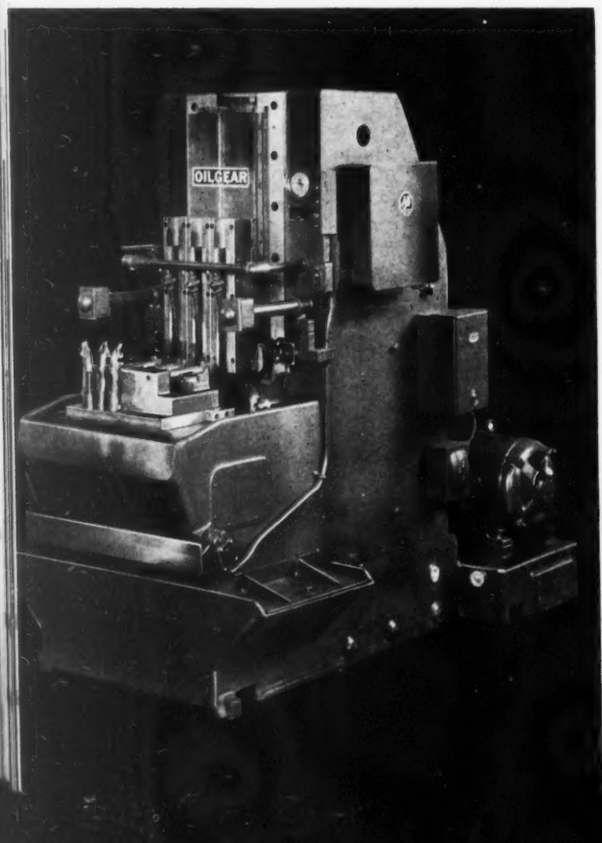


Fig. 3. (Left) Oilgear Single-slide Broaching Machine for Side Surfaces on Rifle Receivers

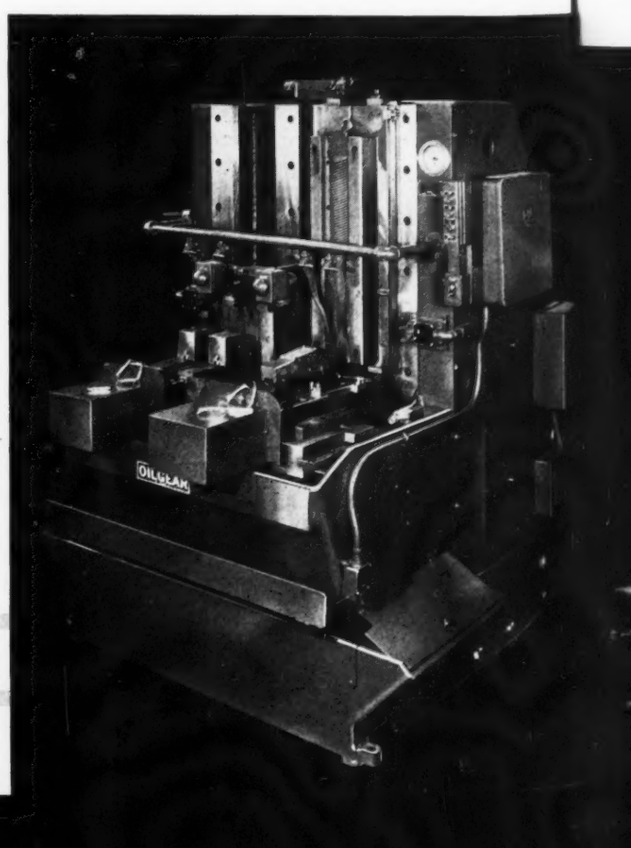
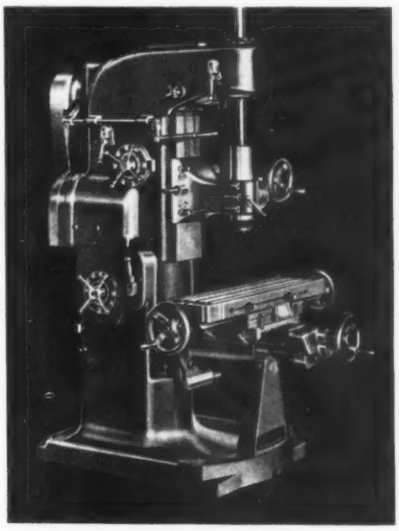


Fig. 4. (Right) Oilgear Double-slide Broaching Machine for Rifle Parts

tons, and having broaching strokes from 30 to 66 inches. It is equipped with the same type of Oilgear pump as the machine previously mentioned, providing for variable broaching speeds up to 37 feet per minute and independently variable return speeds up to 100 feet per minute.

Fig. 3 shows a Type XS-10 x 30 single-slide vertical surface broaching machine with fixture and tools for broaching six side surfaces on three rifle receivers per stroke at a rate of 600 finished pieces an hour. Of this type of machine, five sizes are available varying in normal capacity from 3 to 25 tons, with broaching strokes of from 30 to 66 inches. The Oilgear pumps arranged for direct drive, with which these machines are equipped, provide for variable broaching speeds up to 37 feet per minute.

Fig. 4 shows a Type XD-10 x 30 double-slide vertical surface broaching machine with tools and fixtures for performing operations on rifle parts. One flat and two angular surfaces are finished on two parts per stroke on the right-hand slide at the rate of 460 pieces an hour, while four side surfaces are finished on each of two parts per stroke on the left-hand slide at the same rate of production. The clamping and unclamping of the parts are fully automatic. Of this type of machine, five sizes are being built varying in normal capacity from 3 to 25 tons and having broaching strokes of from 30 to 66 inches. Broaching speeds up to 37 feet per minute are provided for.



Knight Smaller-sized High-speed Vertical Milling Machine

Knight High-Speed Vertical Milling Machine

A No. 20 high-speed vertical milling machine has just been announced to the metal-working trade by the W. B. Knight Machinery Co., 3920 W. Pine Blvd., St. Louis, Mo. This machine, which is similar to the No. 30 model described in January, 1938, MACHINERY, page 341, but smaller in size, incorporates the versatile feature of a tilting and swiveling table.

Cincinnati-Bickford Jig-Boring Machine and Radial Drill

A new jig-boring machine and a 2 1/2-foot high-speed radial drill are new developments of the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio. The "Super Service" jig-boring machine (Fig. 1) is introduced after four years of development and tests. This machine is primarily intended for jig, fixture, and die work in tool-rooms, for plants specializing in tool manufacture, for drill-head builders, and for makers of special machinery. It will also prove useful in the production of accurate parts in lots too small to justify the making of jigs.

The machine has twelve spindle speeds and nine power feeds, ranging from 0.002 to 0.020 inch per revolution of the spindle. The direction of feed can be reversed instantly without changing the direction of spindle rotation. A feature of this machine is the use of broad bearing surfaces and long narrow guides for the table, saddle, and sliding head. The saddle is mounted on the wide bed with a taper-gibbed narrow guide, 38 inches long. The table never overhangs the saddle, nor does the saddle at its extreme position overhang the bed. The screws for

Fig. 1. (Left) Cincinnati-Bickford Newly Developed Jig-boring Machine

Fig. 2. (Right) Cincinnati-Bickford 2 1/2-foot High-speed Radial Drill

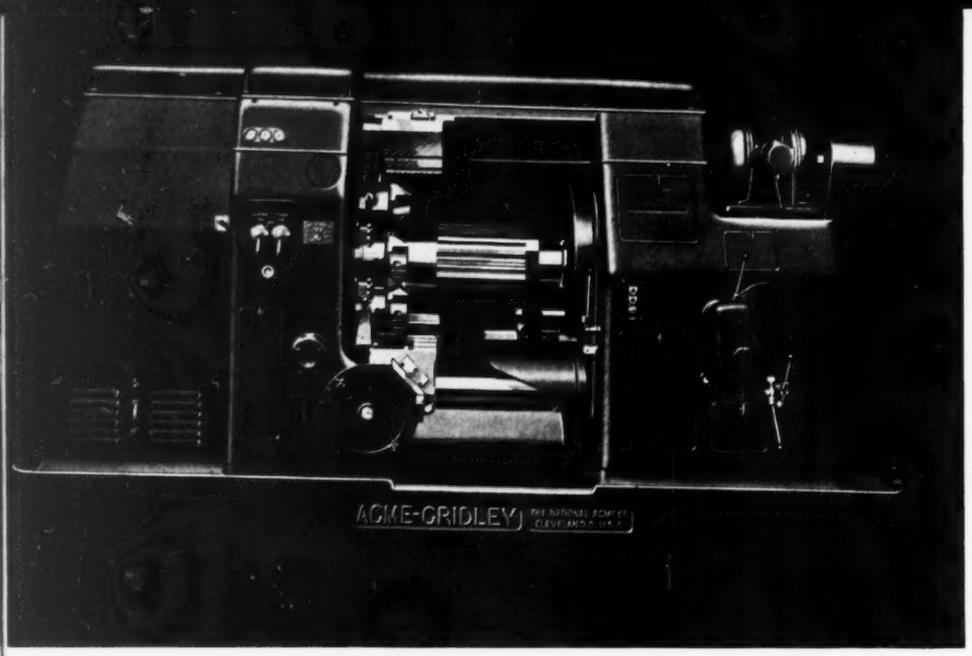


Fig. 1. Acme-Gridley Six-spindle Chucking Machine which has a Weight of Approximately 30 Tons

moving the saddle and table are each fitted with an 8-inch diameter dial graduated in thousandths of an inch. One turn of the dial equals 0.200 inch. The weight of the machine is approximately 8200 pounds.

The high-speed, all-geared, small radial drill (Fig. 2) was developed especially for manufacturers whose operations include much small drilling and tapping in fairly large parts. Three changes of spindle speeds are available; with a 1200-R.P.M. driving motor, these speeds can be in any one of several ranges. Six spindle speeds can be obtained by using a two-speed alternating-current motor instead of the constant-speed type. Three rates of power feed—0.003, 0.006, and 0.009 inch per revolution of the spindle—are instantly available.

The machine is shown in the illustration equipped with automatic tapping control, and, when so equipped, the head-moving handwheel is on the left side of the head. When the automatic tapping control feature is omitted, the head-moving handwheel may be either on the right or on the left side of the head, as preferred.

National Acme 30-Ton Chucking Automatic

One of the latest developments of the National Acme Co., 170 E. 131st St., Cleveland, Ohio, is the Acme-Gridley 12-inch Model RPA six-spindle chucking type of automatic. This machine weighs approximately 30 tons and is believed to be the largest of its type ever built. It is provided with mechanically operated feeds and speeds, and full-hydraulic chucks. It is equipped with high-precision adjustable anti-friction bearings and full-splash lubrication.

This machine is designed to produce accurate work at spindle and tool speeds as fast as modern cutting tools can stand. As an example of its production possibilities, the manufacturer mentions that the machining time on a 2.5 per cent carbon heat-treated 18-pound malleable alloy casting was reduced to one-fifth of that formerly required. The operation, in this instance, consisted of boring, turning, facing, and similar cuts.

The high-production and accuracy characteristics of this machine are also available in 8- and 10-inch four-spindle models and in 6- and 8-inch eight-spindle machines.

The range of spindle speeds varies from 23 to 202 R.P.M., the speed of the pulley shaft being 500 R.P.M. A 40-H.P. motor is employed. The nominal outside diameter of the chuck is 12 inches; the maximum swing 12 inches; and the maximum length being turned 12 inches. The machine has an over-all length of 15 feet, a width of 6 feet, and a height of 7 feet 10 inches. The net weight of the motor-driven machine, less motor and tools, is 58,000 pounds, while the domestic shipping weight, including motor and tools, is 61,000 pounds.

Another new product of the company is the Snap-Lock limit switch illustrated in Fig. 2 which has been designed, both mechanically and electrically, for long life in machine tool and other applications. It is intended for all normal circuits on machines, conveyor lines, etc. All operating parts are made of hardened steel, and the electrical contacts and operating mechanism are contained in separate enclosures.

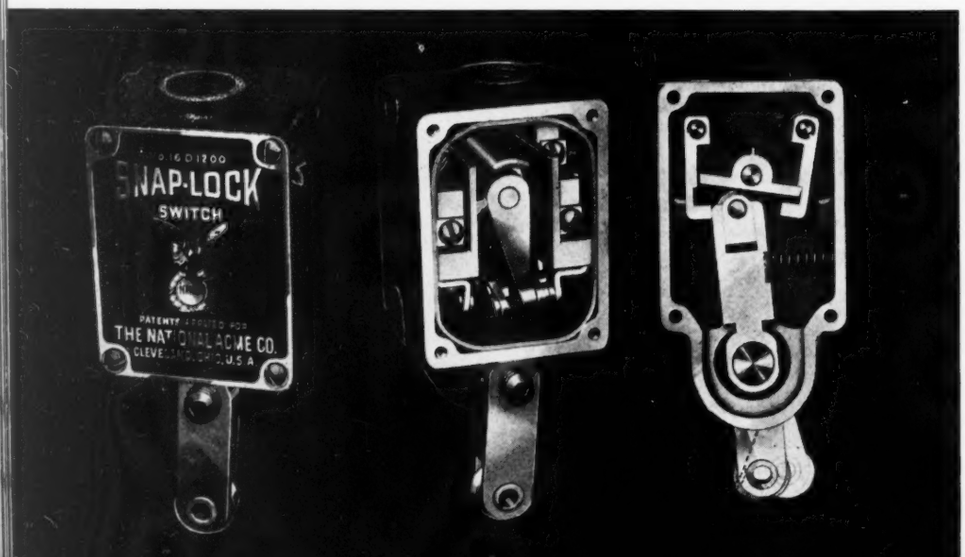
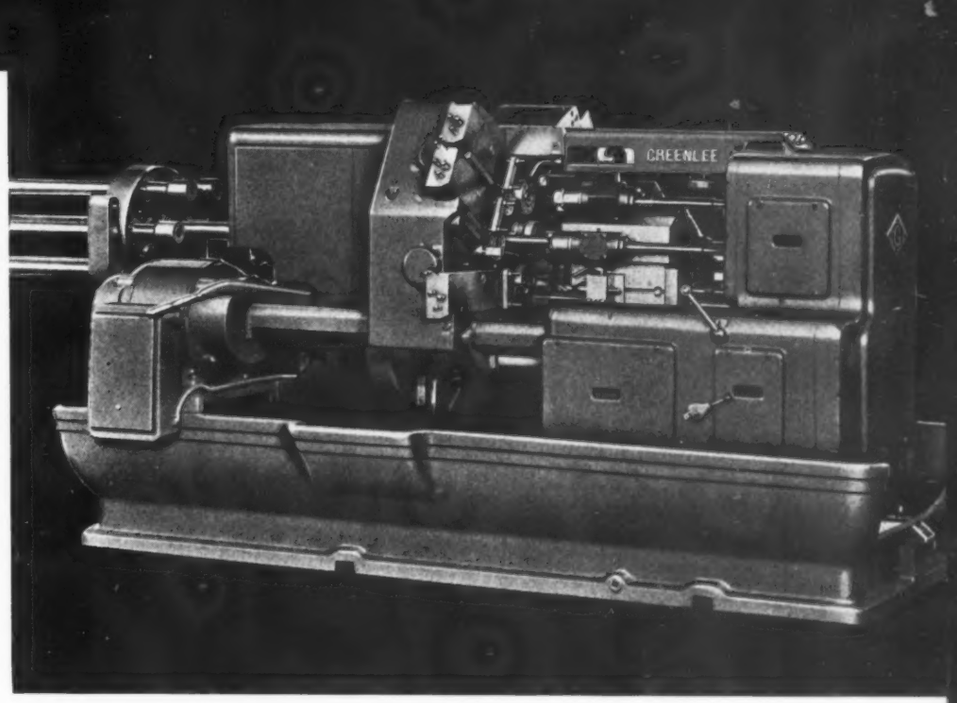


Fig. 2. Snap-Lock Switch Adapted for Use as a Machine Limit, Conveyor, Safety, Counting, or Signal Switch



Greenlee Six-spindle Automatic Screw Machine which is Built in Sizes Having from 1 to 2 Inches Capacity

Greenlee Six-Spindle Automatic Screw Machine

A six-spindle automatic screw machine has recently been brought out by Greenlee Bros. & Co., Rockford, Ill., in ranges from 1 to 2 inches capacity. This machine incorporates a number of new engineering ideas, all of which tend to speed up the setting-up time and reduce the "down" time, so as to increase production.

The machine is equipped with an interchangeable cross-slide cam arrangement, six independent forged-steel cross-slides which have cavities for interchangeability of tooling, a built-in set-up lighting arrangement, rew stock reel features that permit greater ease in restocking the machine, and an automatic cycling stop.

Unusual accessibility of the tooling in all positions, ease of operating control, compactness, and flexibility are other advantages. Threading or tapping can be done in four positions, and high-speed drives are provided in all six positions.

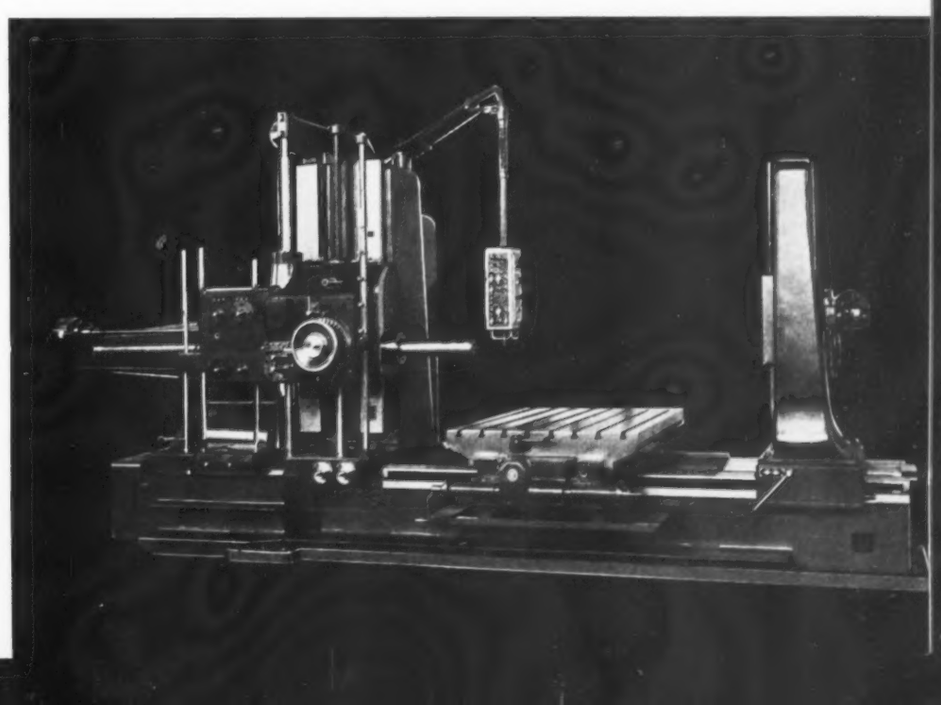
Lucas New Model Large Size Horizontal Boring, Drilling, and Milling Machines

An innovation in control and operation is incorporated in the Nos. 548 and 560 horizontal boring machines built by the Lucas Machine Tool Co., Cleveland, Ohio. These machines are provided with multi-position electric pendent directional control for spindle rotation and traverse of all sliding units, including the spindle, and "Hi-Lo" dual control, at the head or bed level, for shifting gears in the speed and milling feed-change gear-boxes, located on the bed.

The spindle final driving gears are of unusually large diameter for slow-speed high-power drives. The fast speeds are transmitted by multiple V-belts to the rigid 5-inch diameter main spindle, which has a 60-inch continuous traverse by means of a lead-screw, thus making provision for thread leads for screw-cutting. The spindle feeds and speeds are independent of one another.

A large graduated dial at the front of the head indicates directly the distance that the spindle extends beyond the faceplate, thus serving as a depth gage for the full traverse of the spindle. An adjacent dial can be set to trip the spindle feed automatically at any position. The table is provided with so-called "jump feed" crosswise, the adjustable trips being automatically actuated.

Because of the weight of the back-rest, an individual motor with directional push-button control is provided on the base for traversing the back-rest longitudinally along the bed. The back-rest block is clamped in the desired vertical position by means of a torque motor automatically operated by remote control simultaneously with the head clamps, and interlocked with the vertical feed. The saddle clamps are interlocked with the power motion.



Large-size Horizontal Boring, Drilling, and Milling Machine Built by the Lucas Machine Tool Company

The Machine Tool Builder's

NO man who is at all familiar with the work of the machine tool builder—and certainly no manufacturing executive—can have anything but the greatest admiration for the ingenuity, the resourcefulness, and the adaptability with which the machine tool industry has met, or has shaped and guided, the rapid changes of the last thirty years. This period has seen the art of production revolutionized in nearly all of its branches; and that rapid alteration has been particularly evident during the last ten years.

THE first third of this century saw the introduction of high-speed tool steels which increased cutting speeds four- and five-fold. It produced a rapid obsolescence of old machines and old designs and a vast increase in the quantity of production. The National Resources Committee estimates that this one improvement so altered the industrial situation of the United States that the efficiency of all industries underwent an estimated increase of 15 per cent. That would amount to an increased industrial productivity of about eight billion dollars a year, achieved at the expense of about twenty million dollars worth of special steels a year, plus the investment required for new machines capable of using the new tool steels.

CUTTING speeds have gone up and up, as the makers of machine tools have more than kept pace with the metallurgical developments which gave birth to the new cutting materials. The increased use of the new carbide cutting tools has required increased weight and rigidity and vastly greater spindle speeds, which the machine tool builders have furnished unfailingly. At the same time, production work has been made easier and safer for the operator of the machine. Through hydraulic, electric, and other controls greater production has been obtained without increasing the fatigue of the man at the machine. New safeguards have been designed.

MOST important of all, realizing the goal of all this effort and expense, costs of production have gone steadily downward, to the end that more people may have more things and, at the same time, things of higher quality. It is a record to be proud of, and nothing that I shall say is to be considered a criticism. What I have to suggest is said with an eye to the future, rather than to the past. If I seem to imply that all is not yet perfect, that is not carping, but merely evidence that the machine tool builder is like every other man in that, as soon as he has performed a prodigy and the cheers have died down, some one is sure to say, "Now that you have accomplished this miracle, please improve on it."

THE modern machine tools are wonderful things. They have many of the qualities of the human being. Some have, for instance, the sense of touch and will react automatically to very slight pressures. Some machines can be said to have a sense of hearing, based on reaction to sound vibrations. The photo-electric cell has given eyesight to machines. Yet they have several limitations.

THE foremost of these limitations, to my mind, is in the matter of flexibility. If one thinks of machines, as I do, not as substitutes for men, but as things which extend and amplify the ability of men, it is apparent that the machine tool has one great virtue and one equally large defect. The virtue is that it can perform, over and over with exceedingly small variation, a monotonous operation in which accuracy is all important. No man can do that as well as even a poor machine. The man becomes tired or bored, the machine never. The defect is that the machine, in most cases, does only one thing, whereas a man can do a great many different things.

UP to now, the answer to that problem has been, in general, to buy other machines to do other jobs. But that is a very expensive answer, and not altogether satisfactory from the standpoint of the manufacturer who has a budget to live within and limited production costs to meet. That is particularly true in times like these last few years when the other costs of doing business, of making and selling goods, have tended to increase rapidly, and

Next Goal

By A. W. SEACORD
Manager of Manufacturing
International Harvester Co.

A. W. Seacord, manager of manufacturing of the International Harvester Co., graduated from Cornell University, College of Engineering, in 1909. In 1911, he became connected with the International Harvester Co., first working in the rates and methods department at the Auburn Works in Auburn, N. Y. During the following years, he was employed successively in various branches of the engineering and production departments, each change being in the nature of a promotion. He was made assistant superintendent in 1918, and was appointed superintendent of the works in 1920. In 1924, he became assistant works manager; in 1936, works manager in charge of all plants of the automotive group of the company; and in 1937, he assumed his present position at the head of all manufacturing operations of the International Harvester Co.

A. W. SEACORD

put ever greater downward pressure on production allowances. Perhaps the greatest pressure comes from the manufacturer's necessity for frequent style changes in his product. These changes occur so often that the cost of many machines cannot be amortized before they must be rebuilt or replaced at additional expense.

PROGRESS has been made and is being made in the direction of flexibility through such things as the development of sectional bases for machine tools and the use of interchangeable tool-heads. It is with those improvements in mind that I suggest that the field of greater flexibility is one, the continued exploration of which will produce the largest rewards for the machine tool builder and the greatest usefulness to his customers—the producing organizations.

I HAVE confidence that the machine tool industry can successfully overcome any obstacles in the way to that goal of increased flexibility. The overcoming of obstacles, indeed, is the daily routine of that industry. It is that quality of restlessness, of constantly seeking new and better ways to do the job, that has made the machine tool industry of America pre-eminent in the world and has enabled American production methods to yield, at the same time, high standards of quality, diminishing costs, and generosity to labor, which are the envy of other nations.

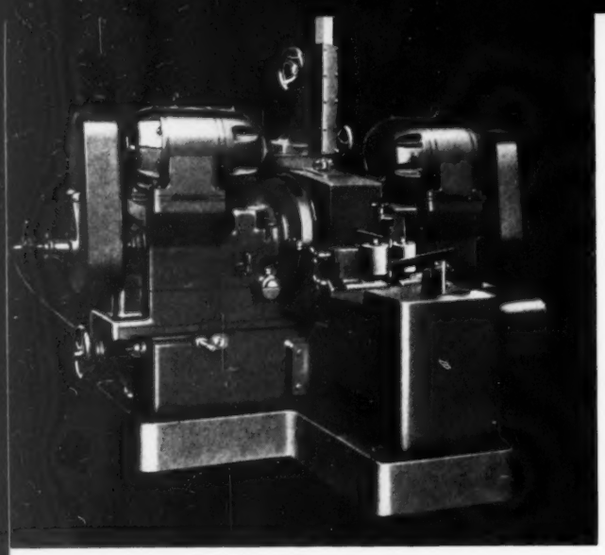
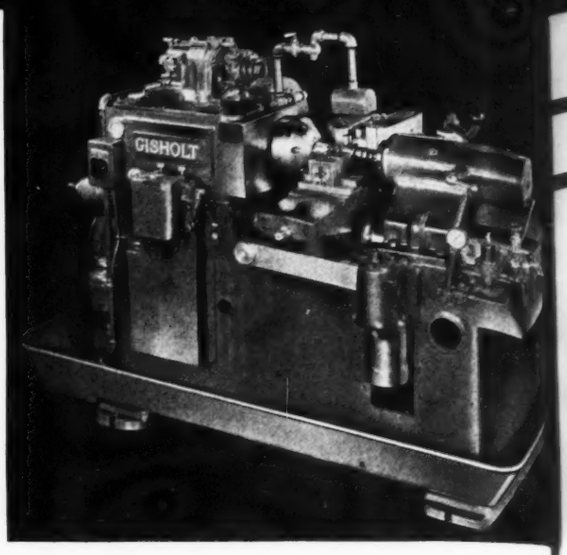


Fig. 1. (Left) Gardner Machine Designed for Disk Grinding 60 to 75 Roller-bearing Races a Minute

Fig. 1. (Right) Gisholt Hydraulic Automatic Lathe Suitable Both for High-production Manufacturing and Small-lot Work



Gardner Precision Disk Grinding Machines

Disk grinding of parts within a few ten-thousandths inch is performed by the large No. 84-30-inch double-spindle grinder illustrated in Fig. 1, which was recently built by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. This machine is equipped with 5 7/8-inch diameter spindles and weighs approximately 15,000 pounds. This machine will be provided with a special rubber-roller feeding fixture for carrying roller-bearing races between the two opposed grinding members at a rate of 60 to 75 a minute.

The work pieces are supported by two hardened steel guide bars which extend through the machine. They are ground to size within 0.0003 to 0.0005 inch with respect to parallelism and within 0.004 inch with regard to uniformity.

Another new machine brought out is the No. 120A-26-inch double-spindle grinder (Fig. 2). This machine is shown set up for grinding both sides of automobile clutch spring disks. The disks are 9 3/8 inches outside diameter by 1/8 inch thick, are made of high-carbon spring steel, and are ground on two parallel faces.

Each disk is carried between the abrasive members by a blade type fixture mounted on a hydraulically operated knee. The knee oscillates to permit several passes or cuts to be taken while the grinding heads are closed hydraulically upon the work. The piece is held loosely enough to permit spinning during the operation.

The disks are held within 0.001 inch for parallelism and within 0.003 inch for uniformity, the average stock removed being 0.006 to 0.008 inch over all. The production ranges from 70 to 80 pieces hourly.

New Gisholt Automatics and Balancing Machines

Among the machines recently developed by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis., are a new hydraulic automatic lathe, a radial type Simplimatic, and a Dynetric balancing machine. Fig. 1 shows the Gisholt No. 12 lathe, which is wholly automatic in operation, the operator simply placing the work in the machine and pulling a lever to start it. It is easily adaptable to a wide range of between-centers work, arbor work, chucking work, and work handled in fixtures. While rugged and powerful, this machine is easily adaptable to light work at high speed, and is as well suited for high-production work as for manufacturing a variety of parts in small quantities.

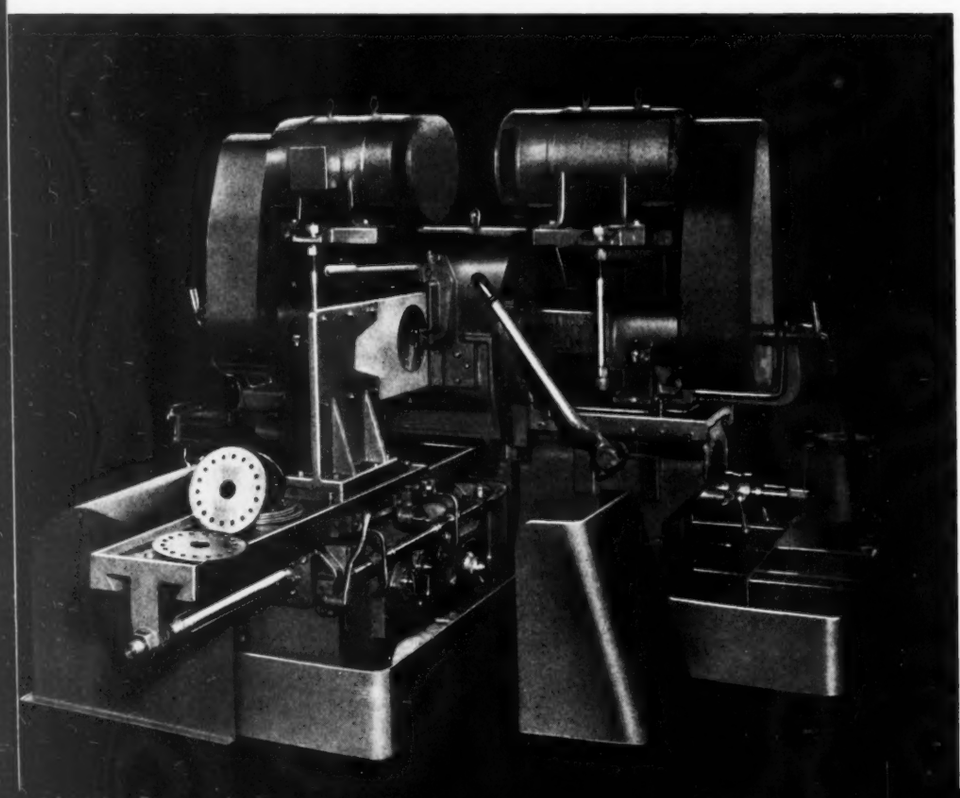


Fig. 2. Another Gardner Machine Built for Grinding Both Sides of Automobile Clutch Spring Disks

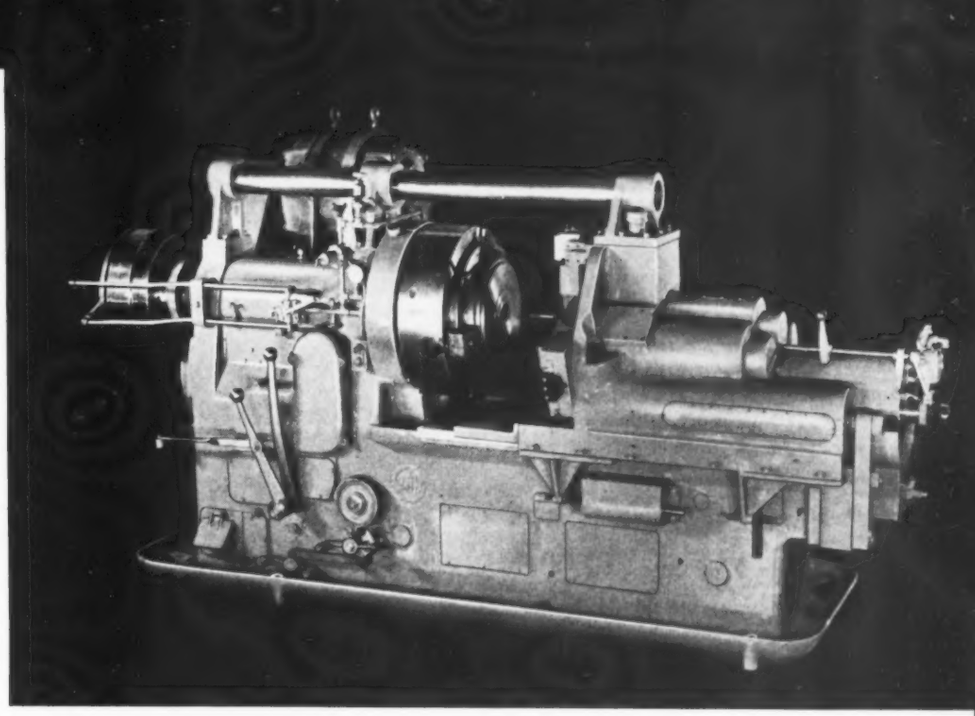


Fig. 2. Gisholt Radial Type Simplimatic with Tool-slides Mounted in a Radial Position on the Vertical Face of the Carriage

The flexibility of the machine is due largely to the means used for obtaining the slide motions and the method of controlling the machine functions. The tool-carrying slides obtain power for their motion through fluid pressure acting on slide pistons, advancing both the front and the rear slides at the rates of feed desired. The adjustment of traverse and feed-trips is merely a matter of loosening, setting, and locking ordinary stop-screws. There are no cams to change, no mechanical trip linkage to adjust, and no trip-dogs to set.

In the radial type Simplimatic (Fig. 2), the tooling arrangement has been designed to permit the maximum number of cutting tools to operate simultaneously at high speed. Several tools are employed to machine a surface instead of using a single tool the entire length of the surface. This materially reduces machining time.

The machine has a carriage with a vertical face on which the tool-slides are mounted in a radial position with relation to the work. This brings the tool-slides close to the work with a minimum of overhang; this rigid support, in turn, increases tool life. Cam segments on a single master drum actuate the tool-slides, giving each its own individual rate of feed. The entire cycle of the machine is automatic. The operator has only to chuck the work-piece and pull the levers to start the machine through its entire cycle. At the completion of the cut, the master carriage and tool-slides return to their original positions and stop. The machine is automatically shifted into neutral and an automatic spindle brake is applied which stops the spindle. The machine is now ready for unloading and reloading. As a safety measure, the two starting levers are located at the rear of the carriage, which requires the operator to have both hands on these levers when starting the machine.

The Dynetric balancing machine (Fig. 3) provides a new means of quickly and accurately locating and measuring unbalance of rotating parts. In actual production, the floor-to-floor time for measuring and locating unbalance is less than half a minute. Dynamic unbalances so small as to cause a movement of less than 0.000025 inch of the work-piece at its bearings are definitely indicated.

In this balancing machine, the work-piece is freely supported—not restrained at either end. The correction for unbalance is indicated directly at the points where corrections are to be made, and without stopping the machine. It is indicated electrically, no optical or mechanical levers or devices being used. Only two switches are employed to obtain the amount and angular positions of corrections required in both correction planes. The machine measures either pure static or pure dynamic unbalance, or the combined effect of both in two arbitrarily selected planes of correction.

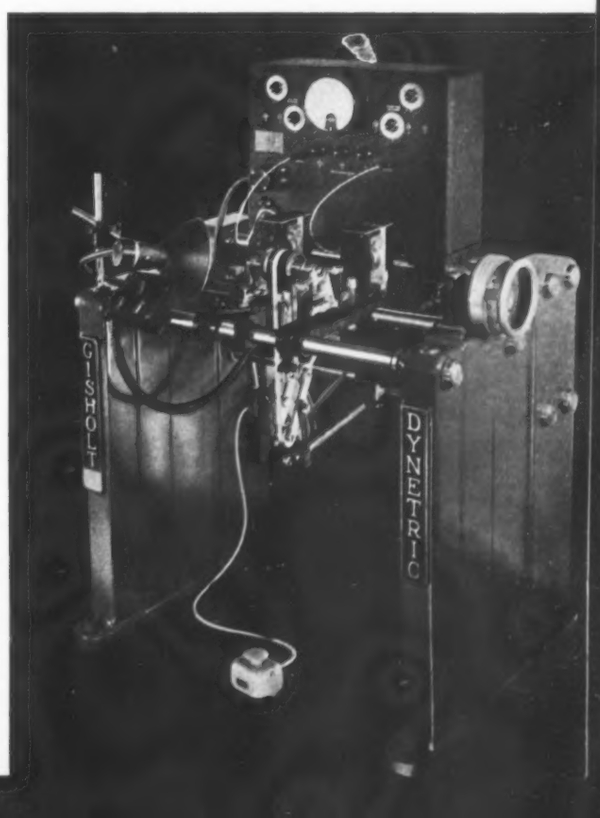


Fig. 3. Gisholt Dynetric Balancing Machine Applied to the Balancing of Armatures for Small Motors

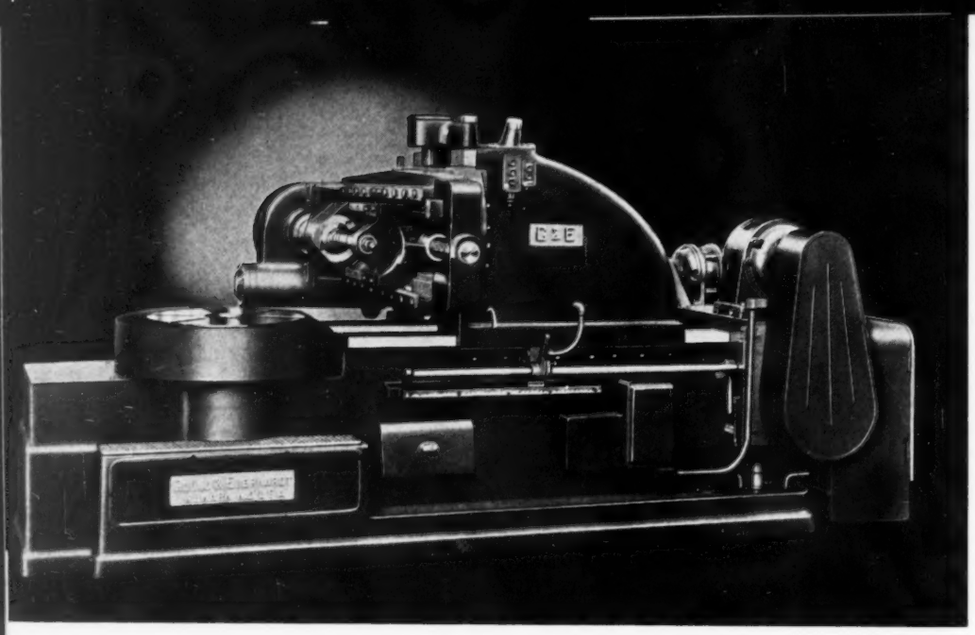


Fig. 1. Gould & Eberhardt Worm-gear Hobbing Machine for Production Work

Gould & Eberhardt New Hobbing Machines and Improved Shapers

The machine shown in Fig. 1 (the No. 40-TWG) is one of a new line of worm-gear hobbing machines brought out by Gould & Eberhardt, Irvington, N. J. This machine has been developed to meet the need for a machine to accurately generate single- and multiple-thread worm-gears on a production basis. Arranged with both automatic in-feed and tangential feed, this machine is intended entirely for the cutting of worm-gears with hobs or fly cutters. Worm-gears of ratios from 1 to 1 1/2 up to 1 to 100 can be produced.

In this machine, the final drive to the work-table is by a patented worm and gear, designated as "dual lead worm gearing." The worm, as the name implies, has a different lead on each of its profiles, thereby producing a thread that varies in thickness from one end of the worm to the other. The mating worm-gear is correspondingly modified on each of its profiles, so that a proper conjugate tooth action is attained in either direction of rotation. By adjusting this dual lead worm axially, the backlash is controlled without disturbing the center distance or affecting the transmission of uniform motion.

The machine is driven from a motor mounted on the main gear-case at the rear of the machine. A separate motor operates the rapid power traverse for the tangential head, or the stanchion movement toward or away from the blank axis.

Fig. 2 shows a 16-inch tool-room universal shaper which has just been brought out by the company. The rapid power traverse mechanism for the work-table, as well as power rapid vertical traverse, is available on all machines. The tool-room shapers are high-speed machines having cutting strokes up to 200 feet per minute. The main double-crank gear transmission of former models has been retained, as well as the rail clamp for locking the cross-rail, the single-control head lock, and the positive lock front-table support.

Among other machines, the company announces a No. 48-H gear-hobbing machine of the universal manufacturing type, restyled and made heavier to meet present production requirements. This machine has a number of new features and improvements, as well as a complete new line of attachments. The index worm and gear are of the patented "dual lead worm gearing" type.

American Hydraulic Broaching Machines

Three hydraulic broaching machines have been brought out by the American Broach & Machine Co., Division of the Sundstrand Machine Tool Co., Ann Arbor, Mich. The 4-ton single-ram machine illustrated in Fig. 1 is equipped with two independent hydraulically operated work-tables. When the "start cycle" push-button on one side of the machine is pressed, the work-table on that side automatically advances into the broaching position, the ram descends to broach the work, the

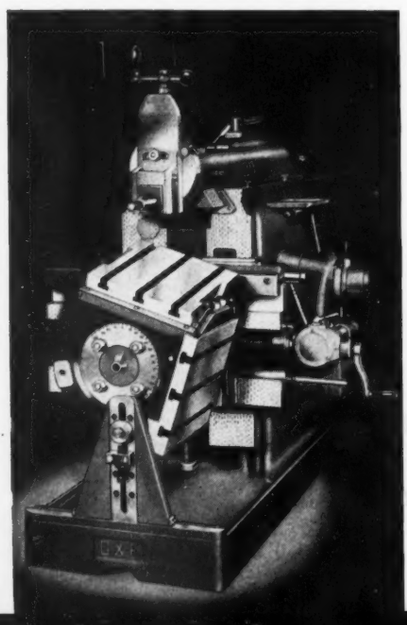


Fig. 2. (Left) Gould & Eberhardt 16-inch Tool-room Universal Shaper

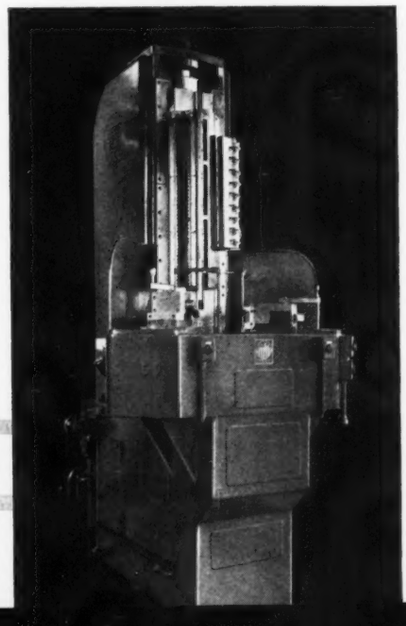
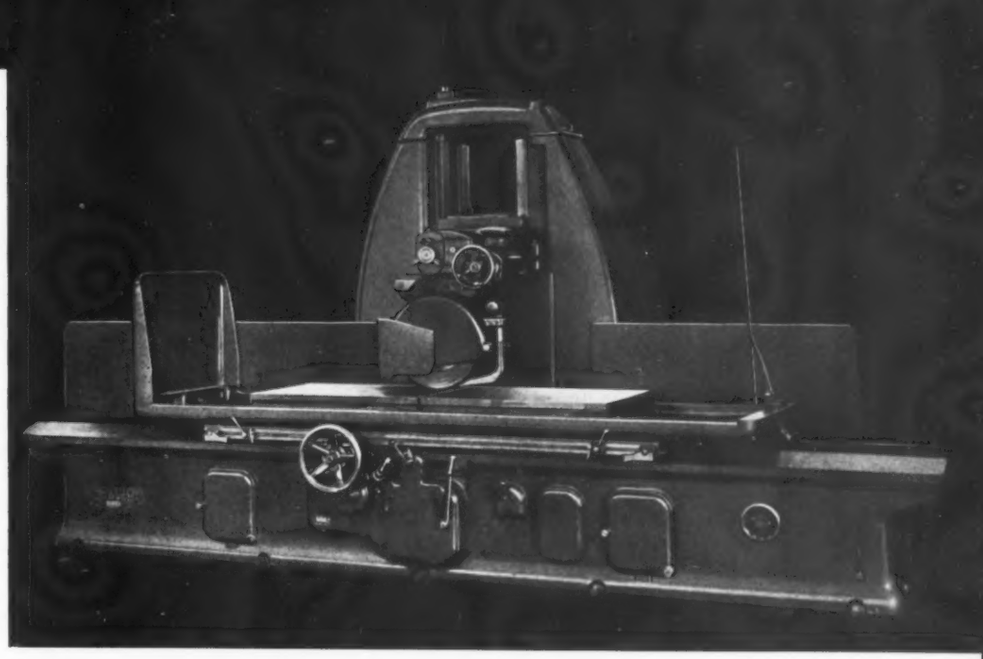


Fig. 1. (Right) American 4-ton Single-ram Surface Broaching Machine with Two Independent Work-tables



Mattison High-powered Precision Surface Grinding Machine with Hydraulic Feeds

table recedes to the loading position, and the ram returns to the top of its stroke. During this time, the operator reloads the fixture on the other table. He presses another "start cycle" push-button to repeat the cycle on the second side of the machine. Safety interlocks insure that neither table can advance until the ram reaches the top of its stroke or the opposite table is out of the broaching position.

The machine shown in Fig. 2 is of the standard construction employed by the concern, the machine slide and the main cylinder being cast integral. This machine is also arranged with hydraulically operated sliding work-tables. These tables are interlocked with the slides, so that when either table is in the broaching position with the corresponding slide passing through the broaching stroke, the other table is in the loading position and its slide is making a return stroke. This machine has a normal capacity of 6 tons and a maximum capacity of 9 tons on each slide. The normal stroke is 42 inches, and the maximum broaching speed 30 feet per minute.

A vertical hydraulic pull-up internal broaching machine with four broaching stations is shown in Fig. 3. This machine operates on a semi-automatic cycle, stopping at the end of each complete cycle. With the four broaches in the down position, the work-pieces are manually loaded over the broach shanks. Upon starting the cycle, the broaches move up and are automatically connected with the broach pullers. As the parts are completely broached, they drop off the broaches and are shunted to the front of the work base, where they can be removed by the operator. In the particular operation shown, 900 pieces are broached per hour, with the machine operating on the basis of 100 per cent efficiency.

Mattison High-Powered Surface Grinder

A high-powered precision surface grinder with hydraulic feeds has been developed by the Mattison Machine Works, Rockford, Ill. In addition to handling regular flat work, the high power, wide range, capacity and rugged construction of this machine adapt it for performing unusual grinding work at a great saving in time.

A special feature of this line of machines is the massive double-column support for the wheel-slide assembly. Wide bearing surfaces on the face of the columns and dovetail bearing surfaces on the back provide an eight-point support of great stability. The wheel-spindle, with its totally enclosed built-in motor, is mounted in an exceptionally heavy housing. The table has a non-differential, twin-cylinder hydraulic drive, providing equal speed in each direction, as well as fully cushioned, smooth reversal and positive longitudinal travel of the table. The transverse feed of the wheel is also hydraulically operated, all operating and adjusting controls being at the front of the machine.

Fig. 2. (Left) Another American Broaching Machine with Two Hydraulically Operated Broaching Slides and Work-tables

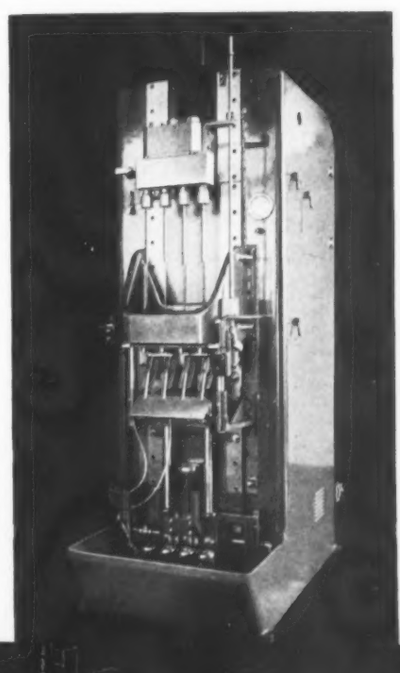


Fig. 3. (Right) Hydraulic Pull-up Internal Broaching Machine Arranged with Four Broaching Stations

Taking the Mystery Out of Machine

IT is becoming more and more obvious to everyone engaged in the machine shop industry in a supervisory capacity that the old-time mechanics are disappearing. To a large extent, even toolmakers and machinists are becoming specialists. The regular machine operators in all of our large mass-production plants are definitely specialists. This fact presents new problems to the machine tool manufacturer and designer. It becomes more and more necessary to design machine tools that are fool-proof. In other words, the mystery must be taken out of machine tool operation.

ONE of the first requisites of modern machine tool design, therefore, is to provide simplicity of operation. This does not mean simplicity in the design of the machine. On the contrary, the machine will frequently become more intricate in its design, the simpler it is to operate. Many of the functions that in the past were performed by the operator are now performed by the machine itself through the liberal use of automatic or semi-automatic mechanical, electrical, or hydraulic operating and control equipment.

REFERRING to a few specific examples, it may be mentioned that at the Schenectady Works, electrical equipment has been built into several vertical boring mills so that precision measurements are made automatically of turning, boring, and facing operations; these measurements were formerly made by the operator, requiring not only considerable skill and time, but also increasing the liability of mistakes.

THE new equipment consists of precision automatic control of both the longitudinal and vertical movements of the cutting tool, each of which is predetermined by the setting of three adjustable dial indicators, graduated in feet, inches, and thousandths of an inch, respectively. The vertical center line and a horizontal plane are established as bases, and the location of each is indicated on the adjustable dials as 0. With these bases as references, the dimensions of all other machined surfaces are determined by dial settings without the necessity of any further measurements.

ANOTHER example is a vertical press having over thirty punches and dies, which can be power-indexed to a single working center, and which are all set up in advance to perform a multiplicity of operations in sequence. A horizontal table for holding the work is movable in two directions along easily read scales, so that any part of the work can be readily located at the working center. For each operation, the operator has only to index the machine and move the work to the proper location, as read from a chart. This chart, provided by the Engineering Department, lists each operation and its center location in terms of dimensions that correspond to the movements of the work-table.

AS still another example may be mentioned a horizontal boring mill equipped with a telescope and a periscope, through which the operator of the machine locates every hole to be bored with great speed and precision. Recent developments include automatic sizing of refrigerator cylinder bores to limits of 0.0001 inch, and automatic sizing of crankpins to the same precision.

IN the building of machine tools, a great deal has been done to provide adequate lubrication to prevent overheated bearings and breakdown of the machines. Still more can be done in this direction to provide what I like to call "safe lubrication." Valuable additions on many machines are safety devices that prevent overheating of bearings by the lighting of a signal lamp in case the oil flow should stop or the bearings become overheated. The introduction of thermostats at the friction surfaces in order to control the bearing temperatures is one means to this end. A valuable safety feature is an interlocking arrangement between the lubricant pump and the main drive which makes it impossible to start the machine until the oil-pump is in operation.

Tool Operation

By B. G. TANG
General Superintendent
General Electric Co.
Schenectady, N. Y.

B. G. TANG

ANOTHER recent development relates to indicators that show when the pressure of the cut becomes excessive, due to the dulling of the tool. Here, again, the lighting of a lamp may be employed to indicate that the tool is dull and should be replaced by a newly ground tool. This may be supplemented with a device for automatically stopping the machine when the cutting pressure becomes too great because of a dull tool. Such an arrangement is particularly applicable to lathes for turning shafts of large diameter.

SIMPLICITY of milling machine design has been promoted by the use of an individual motor for driving the spindle and another motor for the table feeds. This eliminates considerable gearing and mechanism between the spindle and the table.

B. G. Tang, general superintendent of the General Electric Co., Schenectady, N. Y., was born in Copenhagen, Denmark. He came to America when he was eleven years old. After having completed his school education here, he learned the toolmaking trade at the Kranz Electric Co., in Brooklyn, N. Y., and afterward worked with the Westinghouse Electric & Mfg. Co. for one year. He then went with the General Electric Co., with which company he has been connected for nearly forty years, first as a toolmaker, and then successively in the positions of assistant foreman, foreman, general foreman, section superintendent, and assistant general superintendent, until he became general superintendent of the Schenectady Works in 1928, the position that he occupies today. He is a member of the American Society of Mechanical Engineers. He is also one of the five members of the Executive Committee of that Society's Machine Shop Practice Division.

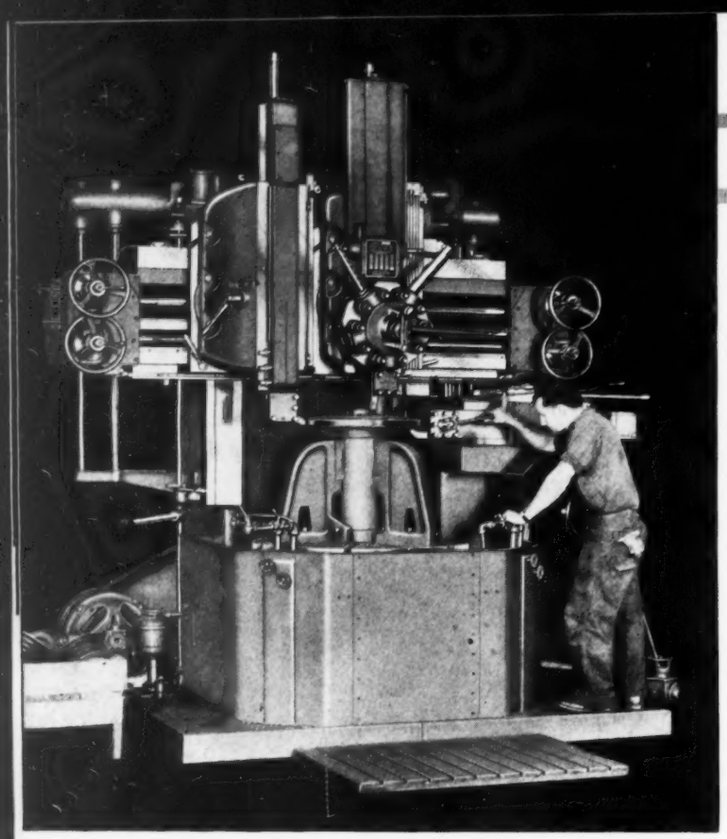


Fig. 1. (Left) "Cut Master" Vertical Turret Lathe Designed to Reduce Cutting Time and Time Between Cuts

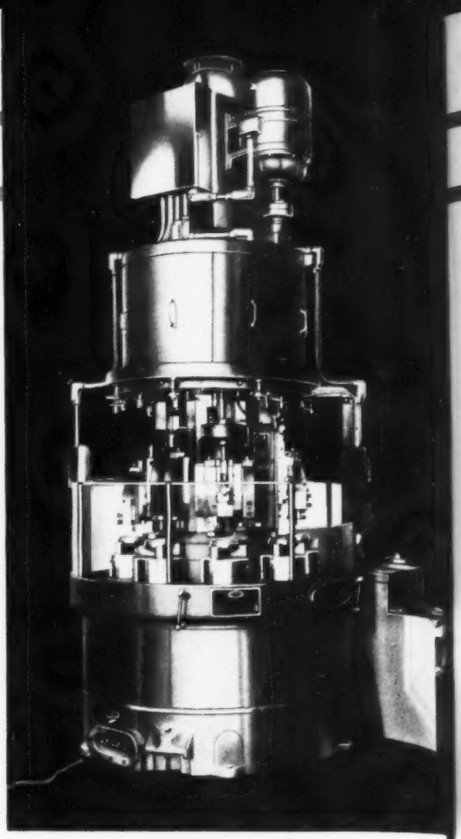


Fig. 2. (Right) Bullard Mult-Au-Matic Intended for Small High-speed Work

Bullard "Cut Master" Vertical Turret Lathes and Mult-Au-Matic

Vertical turret lathes designed to take advantage of the capabilities of carbide and other modern cutting tools are being introduced to the trade by the Bullard Co., Bridgeport, Conn., in five sizes, having tables 30, 36, 42, 54, and 64 inches in diameter. These machines have a wide range of feeds and speeds and are constructed to stand up under high horsepower loads. The basic design widens their scope as compared with previous machines of the same type. For example, in one test a set of single tungsten-carbide tools removed 220 cubic inches of cast iron per minute.

With the exception of the 30- and 36-inch machines, which are designed to carry a main turret-head and a side-head, the machines are arranged for three heads—a left-hand main ram-head, a right-hand main turret-head, and a side-head. However, any choice of heads can be supplied. All heads and functions of the machines are protected by interlocking and limit switches to prevent accidental damage.

The rail-heads can be swiveled 30 degrees either side of the vertical center; they can also be fed horizontally and their rams vertically at the same time, for machining surfaces at angles up to 60 degrees. The two main heads are provided with a screw feed in both the horizontal and vertical directions.

Combining the traverse and feed control of the turret-slide and saddle in one lever located in the center of their respective handwheels simplifies the operation of these units. With this design, there is a natural interlock which prevents feed and traverse from being engaged at the same time.

Each head has its own feed works which functions independently of the others. Feed changes are made without stopping the machine or withdrawing heads from work.

Electric stops are provided for all heads in all directions, as well as for controlling the feed stop-off in approaching finished dimensions. The moving members of the machine are equipped with fixed switches which come in contact with adjustable trip-dogs. This action closes the circuit, thereby reacting on thrustors which, in turn, disengage the feed. There is a selector bar on the turret-head which permits the use of separate trip-dogs for each turret station.

These machines can be operated at table speeds up to 225 R.P.M., because of the large Timken-bearing spindle mountings. Speed changes are accomplished through two ball shift levers at the right of the machine. Anti-friction bearings are supplied at other points, and positive-pressure filtered lubrication is provided throughout the machine. Sixteen feeds are available ranging from 0.0026 to 0.500 inch per spindle revolution.

The Bullard Co. has also developed a Type J-11 Mult-Au-Matic, illustrated in Fig. 2, which is designed for small high-speed work. Combined electrical and mechanical functions provide a high degree of flexibility for rapid change-over from one job to another and for ease of tool setting. Eight spindles allow one station for chucking and seven stations for working. The machine will swing work up to and including 12 inches in diameter for a height of 4 inches above the chuck in the neck of the column, and work up to 9 inches in diameter for 8 1/2 inches of height in the column ways.

The power-operated chucking mechanism is in-built and is provided with an adjustment for various holding pressures. The operation of this mechanism is equally effective on either chucks or fixtures.

A wide range of spindle speeds includes a high range of from 45 to 409 R.P.M., and a low range of from 22 to 198 R.P.M. In either of these ranges, a large selection of independent spindle speeds is available at each station through change-gears. Feed units are provided for each work station which give forty-one feed changes from 0.0079 to 0.0715 inch. Short or long feed

strokes up to a maximum of 7 inches can be obtained.

The Bullard patented feature of double indexing is available to provide for first and second chuckings on the same machine. With this arrangement, there are two adjacent loading stations and three working stations for each chucking. Toolheads of plain vertical, plain compound, double-purpose, and universal types are available, and a live-spindle drill head can be applied at any station. A thread-cutting attachment covers a wide range of work.

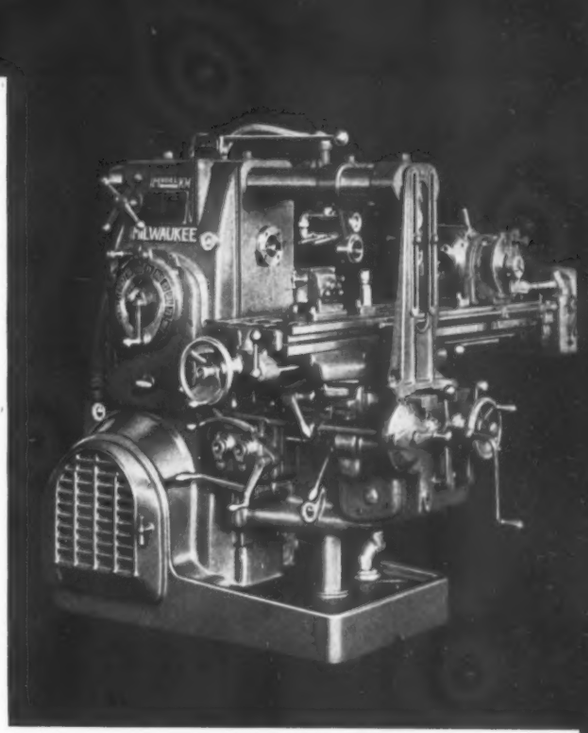


Fig. 3. Kearney & Trecker Universal Milling Machine with Spiral Dividing Head and Low-lead Attachment

Kearney & Trecker Milling Machines

A milling machine equipped with a rotary spindle head in which the spindle can be set off center radially and rotated in a planetary manner is an important recent development of the Kearney & Trecker Corporation, Milwaukee, Wis. The spindle is mounted on cross-slides and can be offset accurately from 0 to 4 inches by means of a precision screw and micrometer dial. The tool-spindle is driven by an individual motor, and the rotary head is revolved by another motor. The spindle and head can be revolved in either direction independently of each other.

The primary advantage of this machine is that all lay-out work, milling, drilling, boring, and slotting operations on a die can be completed without resetting the work. The rotary head can be revolved either by hand or by power through a full 360 degrees or through any part of a circle. The periphery of the rotary head is provided with a T-slot in which trip-dogs are set for disengaging the automatic feed at any point in the rotary travel. Sixteen feeds ranging from 1/5 to 3 R.P.M. are available. The head is graduated in degrees and its handwheel in minutes. Index-plates can be attached to the machine for indexing the spindle in the same manner as a rotary table.

With the spindle set at zero, by inserting a 1-inch measuring block between two hardened pads, the machine is adapted for regular vertical milling. The spindle is mounted in a quill having 3 inches of vertical movement which may be either power- or hand-operated. There are eight vertical power feeds ranging from 0.0002 to 0.008 inch per revolution, while the spindle speeds range from 250 to 6000 R.P.M. The variable type of driving mechanism permits an infinite number of speeds.

Fig. 2 shows the newly developed swivel-head vertical milling machine, available in two types—manufacturing and plain—and in two sizes. This machine was designed primarily for increasing production through greater ease of set-ups for angular milling, and is, therefore, especially adapted for the manufacture of small precision parts.

In order to more fully cover the precision heavy-duty milling field, the company has introduced a medium-speed machine known as the KM type, available in two sizes, and in plain, universal, and vertical types. This line of machines embodies all the features of the regular Milwaukee Model K machines. The new models have sixteen speeds in geometric progression.

Sixteen feed changes are available in one continuous series from 1/2 inch to 30 inches per minute for table and saddle movements, and from 1/4 inch to 15 inches per minute for vertical, knee, and head movements.

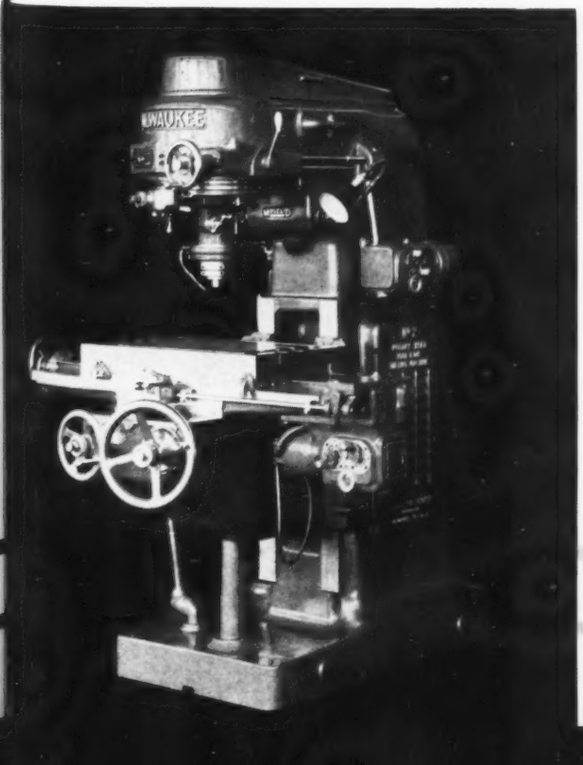


Fig. 1. (Left) New Tool and Die Milling Machine Designed by Kearney & Trecker Corporation

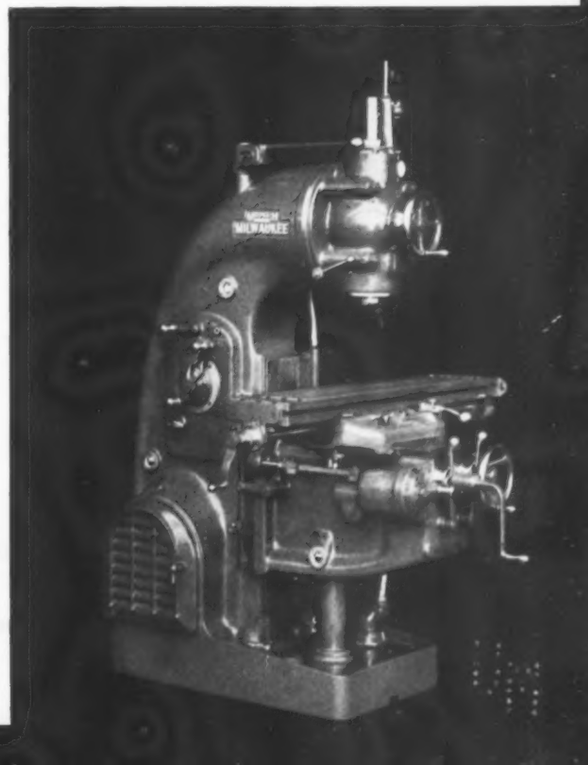


Fig. 2. (Right) Kearney & Trecker Swivel-head Vertical Type Milling Machine

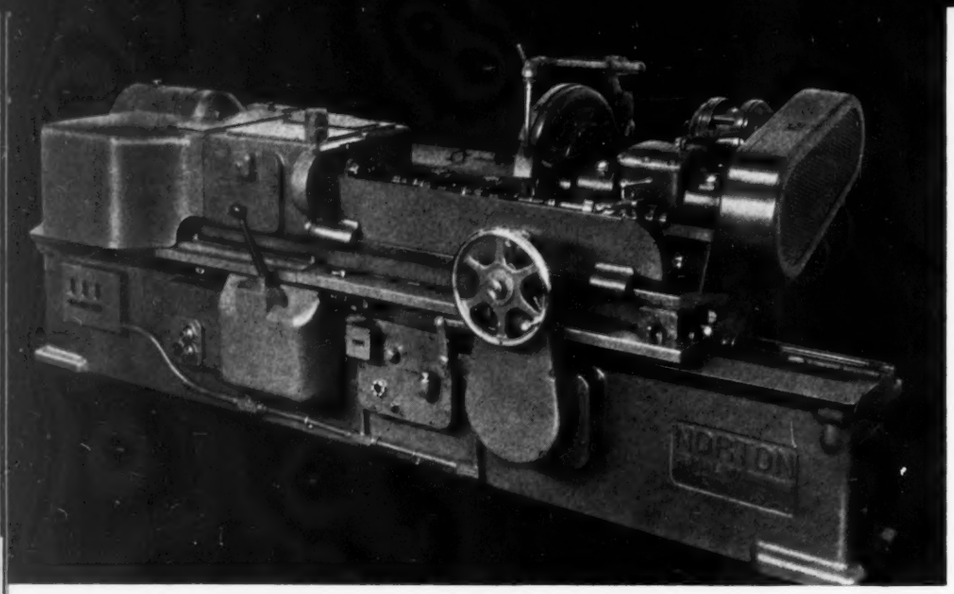


Fig. 1. Norton Automatic Camshaft Grinder Designed for Feeding the Work to the Wheel instead of the Wheel to the Work

Latest Types of Norton Grinding and Lapping Machines

Grinding and lapping machines of improved design, as shown in the illustrations, are being placed on the market by the Norton Co., Worcester, Mass. One of the principal features of the automatic camshaft grinder (Fig. 1) is that the work is fed into the grinding wheel, whereas on all previous machines of this type, the grinding wheel has been fed into the work. With the latter method, the frequency of contacts between the wheel and the work subjected the ways of the relatively heavy wheel unit to a large amount of service. Furthermore, the inertia of the slide required that the propelling elements be designed to withstand this constant movement back and forth. With the new method of feeding the work into the wheel, the lighter member is operated frequently, and the standard 10-inch Type C wheel unit can be employed, with consequent simplification of manufacture.

The feed is accomplished through an eccentric master-cam roll-shaft, which is rotated through part of one revolution by an oil motor. The cam size is obtained when the eccentric motion of the roll-shaft is arrested by a positive stop. With this method, a very fine feed can be obtained.

Timing of the cycle is controlled from the revolution of the shaft and the oscillation of the rocking bar that supports the master cams and the camshaft. Each cam makes the same number of revolutions in contact with the grinding wheel, and this number is adjustable by turning a knob.

Because lapping is now playing an extensive part in the manufacture of camshafts and crankshafts in the automotive industry, the Norton Co. has brought out the automatic camshaft lapper illustrated in Fig. 2, which will simultaneously lap all the cams and bearings on any automotive camshaft. After the operator places the work in the machine and moves a lever, the entire operation is performed automatically, including the engagement of the footstock in the work, lowering of the lapping arms, starting of the work rotation, timing of the actual lapping operation, and complete reversal of these operations after the cams and bearings have been finish-lapped. Even the releasing of the work from the centers is automatic.

This machine has been manufactured to lap as many as seventeen cams and five bearings simultaneously. In one application, 225 camshafts are lapped per hour in two machines attended by one operator.

The 6-inch Type C cylindrical grinder shown in Fig. 3 has been redesigned to obtain maximum rigidity, operating convenience, accuracy, and smoothness of appearance. In addition, the production capacity is higher than on previous machines of this size. All mechanisms are easily accessible for adjustment. The coolant and oil pumps are individually motor-driven, run submerged, and are spring-mounted to preclude the transmission of vibration. A separate pump supplies lubricant to the table and to the wheel-slide ways.

The headstock has a new eccentric take-up of the drive chain for keeping it at the proper tension. Electrical controls are built into the back of the machine. Telescoping guards are furnished for the base ways.

In Fig. 4 is shown a No. 26 Hyprolap, which employs two bonded abrasive laps. It is designed for unusually fast cutting. The number of parts that can be finished sim-

Fig. 2. (Left) Machine for Simultaneous Lapping of Cams and Camshaft Bearings

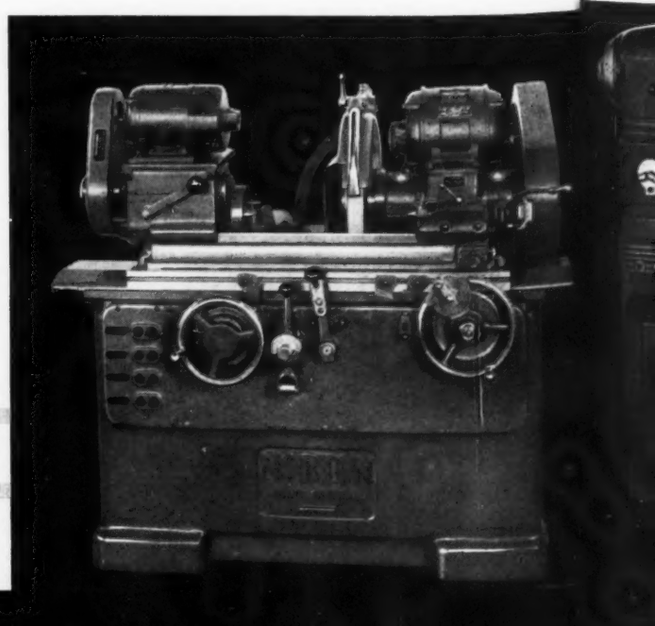


Fig. 3. (Right) Cylindrical Grinder Redesigned for Rigidity, Operating Convenience, and Accuracy

ultaneously in one load depends upon their size. Automotive piston-rings, refrigerator parts, and, in fact, any flat part of a size within the capacity of the machine can be finished flat and parallel within extremely close pre-established limits.

The machine can also be adapted for cylindrical work. A lever regulates the lapping pressure to from 20 to 100 pounds per square inch. A hydraulically controlled swinging arm carries two diamonds for truing the upper and lower lap faces at the same time.

Another recent development of the company is a 10- by 36-inch Type CD crankshaft bearing grinder which is designed primarily for grinding the line bearings of automotive crankshafts. It is a manually controlled semi-automatic machine constructed to receive 42-inch wheels and to remove large amounts of stock quickly and accurately.

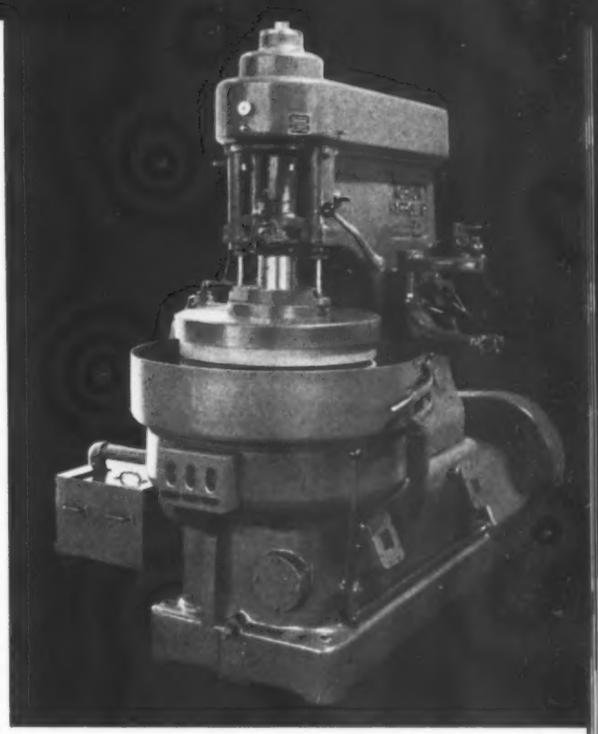


Fig. 4. Norton No. 26 Hyprolap Designed for Finishing Either Flat or Cylindrical Parts

The grinding wheel is advanced to the work hydraulically in three stages, including a fast approach feed, an intermediate or decelerating feed, and a grinding feed. These feeds are all adjustable.

The machine has a 9-inch swing; the draw-in or push-out collets have a capacity up to 1 inch. The spindle speeds vary from 100 to 3750 R.P.M. The machine is guaranteed to turn or bore work held in the collet within 0.0002 inch in 6 inches.

Rivett Screw-Cutting Lathe and Precision Bench Lathe

A number of new machines have been announced by Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass. One of these (Fig. 1) is the No. 1020 back-geared screw-cutting lathe having ball-bearing mounted spindle, quick-change gears, heavy box-section bed with three-point mounting, and separate ways for carriage, saddle, and tailstock. The lathe is mounted on a steel cabinet enclosing the motor drive and provided with two drawers for collets and attachments.

The driving unit consists of a commutator type motor energized from an alternating-current supply by means of a grid-controlled rectifier. This rectifier is so connected that any desired speed is automatically maintained, regardless of load variations. The speed is continuously variable, through the movement of a graduated control knob, from 100 to 2500 R.P.M. The lathe will swing 10 1/4 inches diameter over the bed. It will cut threads from 7 to 156 per inch. The feeds range from 0.001 to 0.028 inch. The weight of the lathe mounting and drive is approximately 1100 pounds.

The No. 918 plain precision bench lathe (Fig. 2) has been developed to increase the productive capacity of this type of machine, making it suitable for quantity-production work.

Infinitely Variable Speed Transmission

Two new sizes of P. I. V. gear variable-speed transmission units have been brought out by the Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa. A 1/2-H.P. No. 0 size is available for a speed ratio of 2 to 1 or 3 to 1, and a 1/2-H.P. No. 1/2 size is available for ratios of 2 to 1, 3 to 1, and 4 to 1.

These smaller sizes, like the larger units ranging up to 15 H.P. with speed ratios up to 6 to 1, can be furnished for horizontal or vertical mounting, motorized or with or without integral motor, and with or without extra speed reduction gear sets.

Fig. 1. (Left) Rivett Back-geared Screw-cutting Lathe Mounted on Metal Cabinet

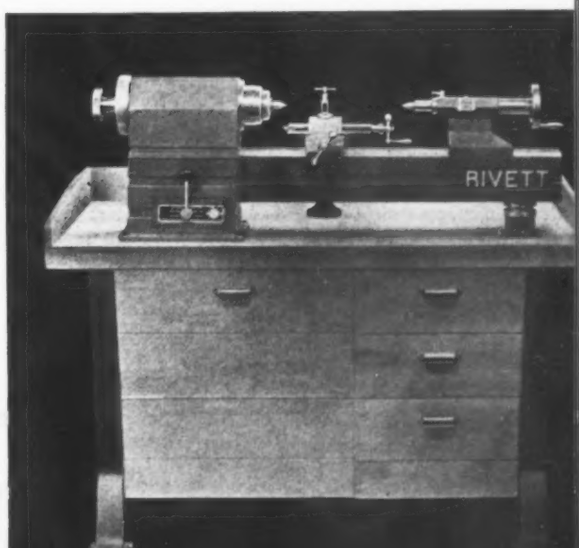


Fig. 2. (Right) Precision Bench Lathe Suitable Both for Tool-room and Quantity-production Work

Making the Special Machine Tool

By O. W. YOUNG, General Manufacturing Manager
Buick Motor Division, General Motors Corporation
Flint, Mich.

AS we measure the progress of the automobile industry during the last few years, we cannot fail to recognize the great contributions that have been made by the machine tool builder. He has made many of the achievements of the automobile manufacturer possible. Everyone closely identified with the automobile industry is convinced that the machine tool designer will continue to play a most important role in the future developments of automobile manufacturing.

THE increase in demand for automobiles, and the consequent possibility for economical quantity production, has justified the building of many special machines, capable of performing a number of different operations on a part at one setting. The advantages gained by the use of this type of equipment from the standpoint of reduced production costs, economy of floor space, and greater accuracy are thoroughly appreciated throughout the industry.

BASING my prediction as best I can on past experience, I would express it as my opinion that the advantages to be gained from specially designed machine tools will continue to create an even greater demand for this group of machine tools; but I would add that this demand will depend to a considerable extent upon whether or not it will be possible to overcome some of the disadvantages which up to the present time have appeared to be inherent in the design of this type of machine. These disadvantages are the premature obsolescence or the great cost of rebuilding the machines when a comparatively slight change in the part to be machined is being made.

THE machine tool builder has made some notable advances toward flexibility of design; nevertheless, this phase of the engineering of special machine tools offers a wide opportunity for further advances. It is believed that the immediate future will show marked progress in the direction of developing special machine tools that are less special; in other words, machines that will produce as economically, rapidly, and accurately as present-day special machines, but that will be so designed and built that they can be changed over without excessive cost for similar operations on slightly different parts.

THIS, briefly, seems to me the most promising field of endeavor at present for the machine tool builder that serves the automotive industry. The solution of the problem is not going to be easy; were it easy, a solution would have been found long ago. It will require the combined ingenuity of the machine tool builder and the automobile production engineer. It will demand patient cooperation between the two industries, and it will involve a painstaking study of all the factors relating to the problem.

EACH step toward the solution of this problem, however, will mean direct benefits not only to the automobile industry, but also to the builders of machine tool equipment. I feel certain that the immediate future will show marked progress in this direction.

Less Special

ORVILLE W. YOUNG

Orville W. Young, general manufacturing manager of the Buick Division of the General Motors Corporation, entered the employ of the Buick organization in 1907. At that time, he already had experience as a machine repair man in the shops of the Weston Mott Co., Utica, N. Y. He started with Buick as a lathe and boring mill operator. For six years he handled many other types of work, until, in 1913, he was made assistant foreman in the engine plant. Two years later, he became foreman, and in another year was appointed general foreman. His rise was rapid, and in 1919, he was made superintendent of the machine and axle plants. In 1922, he was placed in charge of the body plant, and in 1925, he became superintendent of the sheet-metal department of the company. The following year, he became manager of all sheet-metal operations.

In the well-known Buick development work of the last five years, Mr. Young has played an important part. In 1934, he became general superintendent in charge of all productive operations, and in 1937, general manufacturing manager, directing all manufacturing in what is believed to be the largest self-contained automobile factory in the world.

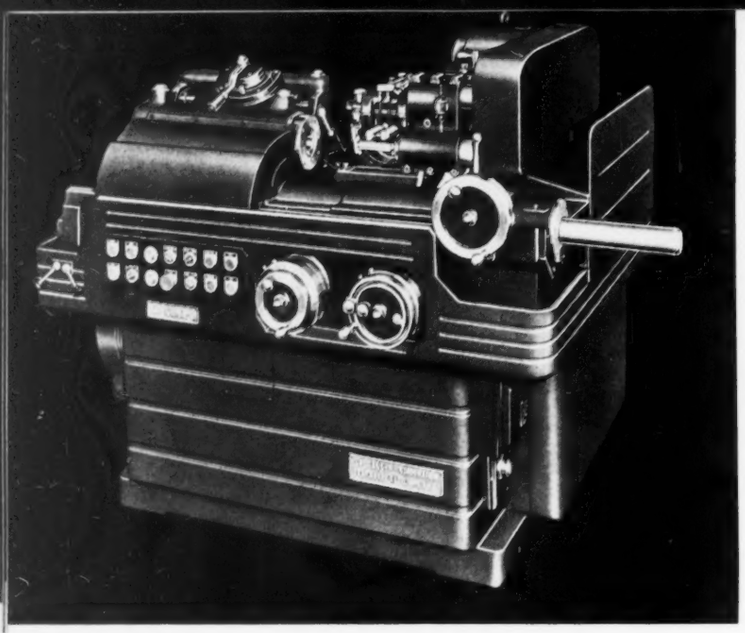


Fig. 1. Ex-Cell-O Machine for Grinding Internal Threads on a Production Basis

Fig. 2. External Thread-grinding Machine Recently Added to the Ex-Cell-O Line

Ex-Cell-O Thread-Grinding and Internal Lapping Machines

Three new thread-grinding machines and an internal lapping machine have recently been placed on the market by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. Of the thread-grinding machines, one is intended for grinding internally threaded parts, another for externally threaded work of medium diameters and lengths, while the third is intended for grinding threads on exceptionally large work. The most unusual of the machines is the one shown in Fig. 1, designed especially for grinding internal threads on a production basis. In this, holes up to 9 1/2 inches in diameter with as much as 4 inches of thread length can be ground in parts up to 10 inches in outside diameter by 13 inches long.

Half-round scraped ways in the machine base support the table and work drive-head which normally traverse in the grinding position. At the operator's convenience, however, the table and work-head can be power-indexed or swiveled toward the operator into a gaging, reloading, and dressing position.

After the work-head is indexed, the grinding wheel dresser can be power-actuated for performing its cycle automatically. All machine movements are electrically interlocked. The grinding-wheel spindle is mounted on the front face of the cross-slide and is adjustable for obtaining the desired helix angle.

Externally threaded sections up to 6 inches in diameter by 8 inches long can be ground on work up to 18 inches in length between centers by the machine shown in Fig. 2. An improved attachment permits the grinding of tapers up to 3 inches included per foot. The grinder employs 18-inch wheels which run in oil coolant. Multiple right- and left-hand threads of any number from 1 to 80 per inch can be ground. Most standard threads can be produced directly from solid hardened blanks on a production basis.

An electrically operated automatic feed attachment can be furnished for high-production runs on a wide range of work. While the table and work-spindle stop momentarily at the end of the table travel, the wheel is fed into the work, and after the desired work size has been reached, the machine stops automatically. An adjustable back-off attachment is also available.

Threads up to 12 inches in diameter and 50 inches in length can be ground on work up to 115 inches long between centers by the Style No. 50 precision thread-grinder illustrated in Fig. 3. This machine is hydraulically operated and controlled, and an infinitely variable range of work speeds is provided by the hydraulic motor.

Automatic features include a wheel-dressing device, which is used at grinding speeds to insure rapid and accurate truing under operating conditions; a grinding wheel in-feed which compensates for the amount of stock dressed off the wheel; and a backlash compensator for grinding in both directions of work rotation and table travel. The hydraulic backlash compensator operates instantly at each reversal to insure that the grinding wheel will follow

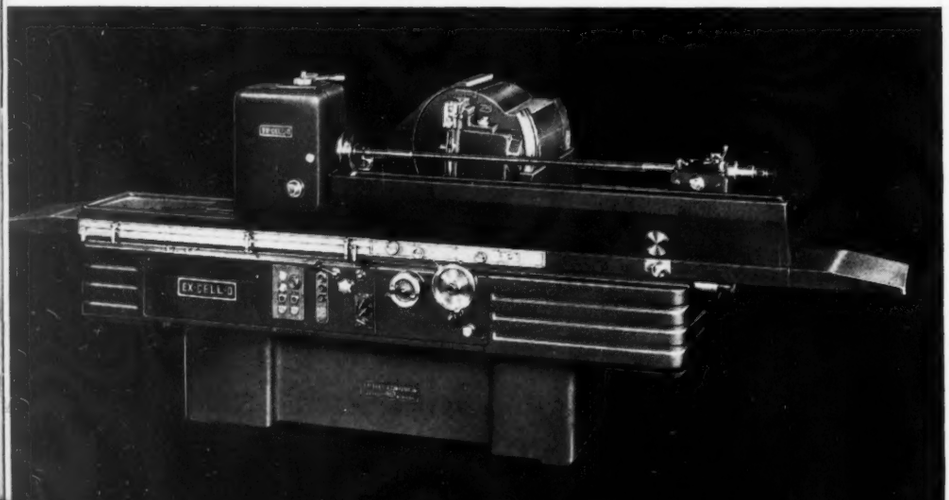


Fig. 3. Another Ex-Cell-O Machine, which Grinds Threads up to 12 Inches in Diameter and 50 Inches Long on Work up to 115 Inches Between Centers

the same thread track. Work can be reversed while the grinding wheel is in the thread cut. A lead control device permits lengthening or shortening the lead to meet metallurgical characteristics of the work.

An internal lapping machine designed by the Ex-Cell-O Corporation to increase the accuracy and reduce the finishing cost of holes from 1/4 inch to 1 inch in diameter is shown in Fig. 4. This equipment is particularly adapted to holes that are difficult to machine by other precision finishing methods, such as internal grinding. Holes interrupted by keyways, milled or cored slots, cross-holes, etc., can be accurately lapped.

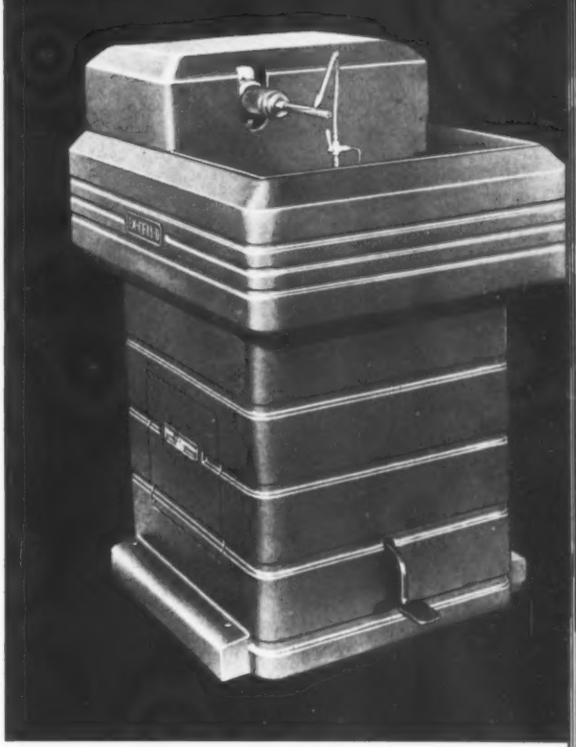


Fig. 4. Internal Lapping Machine for Finishing Holes from 1/4 Inch to 1 Inch

Features claimed for this internal lapping machine include a long lapping-stone life, operating convenience, ease of adjustment for size of hole, ready interchangeability from one hole size to another, and high rate of output. The lapping stones and holders are of unique design, and the lapping stones can be expanded at any place in the hole.

Hardinge Precision Lathe and Second-Operation Machine

Among the machines being announced by Hardinge Bros., Inc., Elmira, N. Y., is a high-speed precision lathe mounted on a pedestal base (Fig. 1), and a high-speed precision second-operation machine, similarly mounted (Fig. 2). In designing the precision lathe, the aim was to provide a machine (1) with proper cutting speeds for all work within its capacity, (2) that would give perfect finish without polishing, and (3) that would allow the use of tungsten-carbide and diamond tools.

The second-operation machine is intended especially for reducing costs in the manufacture of duplicate parts. This machine can also take care of short runs, thereby relieving more expensive automatics, and is useful for producing sample lots of duplicate parts inexpensively. Because of the design, the set-up time is practically negligible.

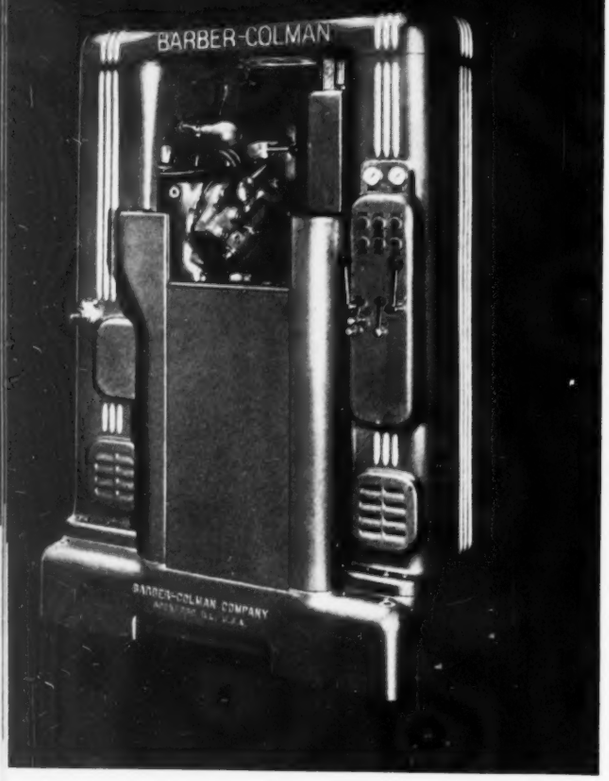
Both of these machines are mounted on welded steel pedestals which fully enclose motors, controls, and driving units, and provide cabinet space for the storage of chucks, tools, collets, and other attachments. The pedestal is arranged as shown to provide foot space for the operator and has openings at each end near the floor to facilitate moving. Provision for bolting the machine to the floor is made inside the pedestal.

Oakite Cutting Oil

An improved type of soluble oil that already is finding wide application due to its adaptability to most types of turning and boring, cold sawing, threading and tapping, light drilling, milling and light broaching has been developed by the Oakite Products, Inc., 26 Thames St., New York City. This cutting lubricant is manufactured from paraffin crude. It has an especially compounded petroleum sulphonate as the emulsifying base. It disperses completely and readily into water, making stable emulsions in the ranges of from 3 to 60 parts of water to 1 part of oil. The emulsion is said to have high cooling capacity and excellent rust preventive properties.

Fig. 1. (Left) Hardinge High-speed Precision Lathe Mounted on Welded Pedestal Base

Fig. 2. (Right) High-speed Precision Second-operation Machine with Pedestal Base



Barber-Colman Vertical Automatic Gear-hobbing Machine Designed for High Production, Accuracy on Long Runs, and Quick Change-over

Barber-Colman Vertical Hobbing Machine

A vertical automatic hobbing machine known as the Type V, which is of distinctive design, as shown in the illustration, has been developed by the Barber-Colman Co., Rockford, Ill. This machine has been designed for high production, accuracy on long runs, and quick change-over.

The outstanding advantages obtained by the vertical design are conservation of floor space, complete accessibility both from the front and rear, and unusual rigidity. Additional advantages are found in the stabilizing effect of gravity as the work-slide feeds upward, and the effect on the rapid traverse downward. Chips and coolant fall directly into the chute provided for them.

Another feature being emphasized is the easy set-up. The speed, feed, and index gears are quickly selected and easily mounted. A positive depth of cut and movement of the work-slide are established by simple adjustments. Central controls give the operator complete command of the individual movements in the cycle.

The automatic operating cycle employs hydraulic pressure for actuating the hob carriage, clutches, and clamping means; mechanical drives to the hob-spindle and screw feed; and electrical drives to the hydraulic unit, coolant pump, and work-slide rapid traverse. The machine is adapted to either conventional or climb cutting. The grouping of the controls and gages, as indicated to the right in the illustration, is a feature that will readily commend the machine to the operator.

New Type of Tracing Paper

An entirely new type of tracing paper, combining the transparency of oil-treated sheets with the permanence of 100 per cent rag papers, is a recent development of the Keuffel & Esser Co., Hoboken, N. J. The new paper is named "Albanene" because it is treated with a new crystal-clear synthetic solid designated as "Albanite," a material developed in the laboratories of this company. Since this new synthetic product is free from oil and wax, and is both chemically and physically inert, it is claimed that the new paper treated with it will not oxidize, turn yellow, become brittle, or lose transparency with age. Albanene paper has a fine-toothed, smooth drawing surface that takes strong lines with a minimum wear on the pencil point. It is made in three weights—light, medium, and heavy.

New Britain Automatic Screw Machine and Chucking Machine

Several improvements are incorporated in the new line of multiple-spindle automatic screw machines brought out by the New Britain Machine Co., New Britain, Conn. In addition to including all the proved

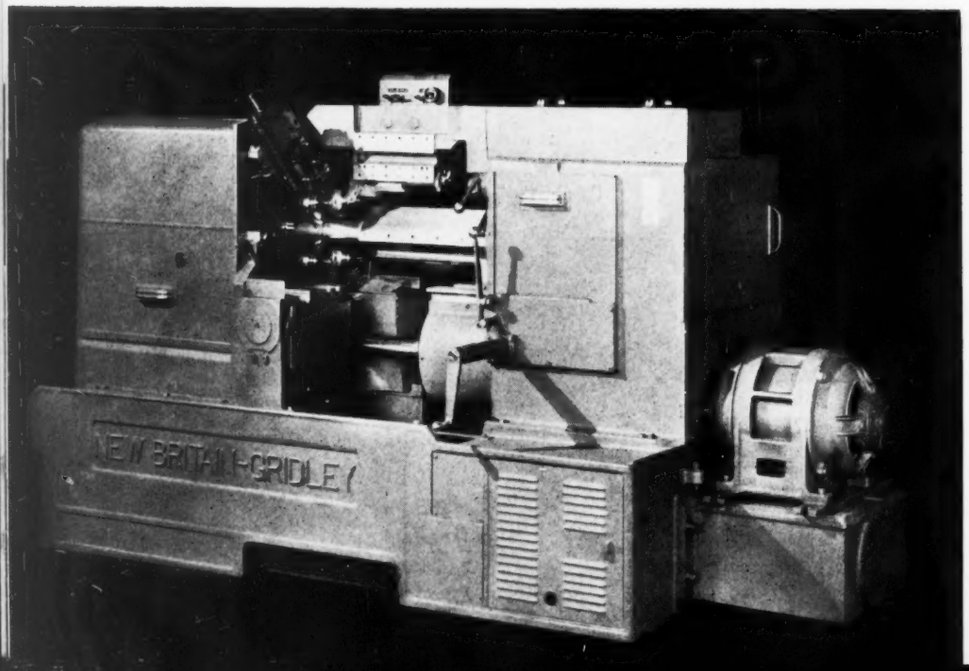
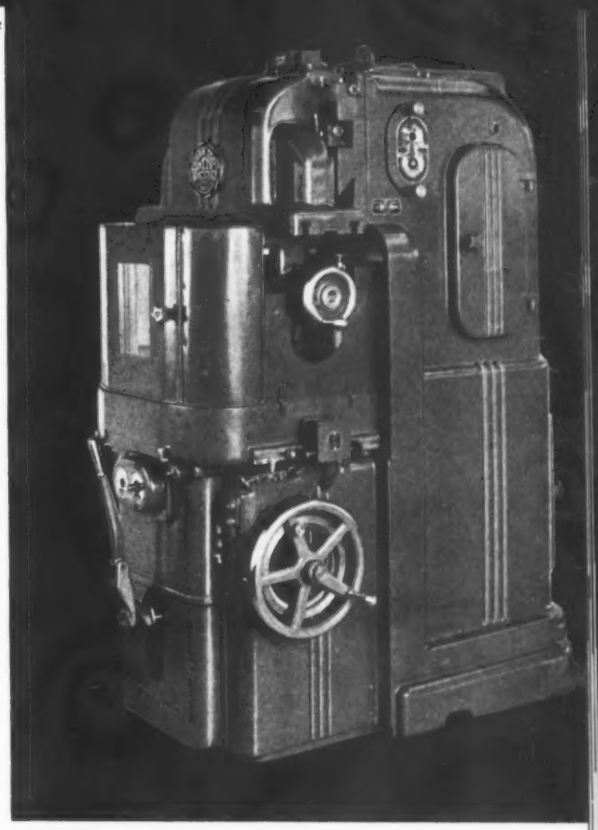


Fig. 1. Improved New Britain Multiple-spindle Automatic Screw Machine

features of earlier types of these machines, they are provided with an automatic electric stop—a mechanism that automatically stops the machine when the stock in any spindle is used up. This device is so timed that the empty spindle stops in the loading position with the collet open. The operator simply removes the butt end and inserts a new bar, after which the machine is immediately under way. A signal lamp gives notice to the operator when the machine stops. The line is built in capacities of from 5/8 inch to 2 5/8 inches.

The New Britain line of work-rotating chucking machines has been broadened by the addition of a four-spindle, Model 475, machine of 8-inch capacity; a six-spindle, Model 665, of 6 3/4-inch capacity; and an eight-spindle, Model 86, of 6 3/4-inch capacity. The first two of these three new models were developed in response to a demand for smaller capacity chucking machines with open-end construction to afford the maximum of accessibility to the tooling. The eight-spindle machine, which is also of the open-end type, was developed to handle more complicated jobs and to make it possible to perform on the machine operations formerly done as subsequent operations. All the machines are provided with a hydraulic chucking arrangement having means for automatically reducing chucking pressures in the loading position—a feature especially valuable when fragile pieces are handled.



Michigan Gear-finishing Machine Designed for Finishing Gears up to 5 Inches in Width as well as Splines on Long Shafts, without Using Wide Cutters

Michigan Gear-Finishing Machine of Wider Range

Gears up to 5 inches in width, as well as splines on long shafts, can be finished without the necessity of using wide cutters, on an 860-A rotary crossed-axis gear-finisher brought out by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., as a companion machine to the 860 finisher recently described. For such work, the standard fore and aft table feed is locked out and a combination of reciprocating transverse work-head travel and vertical table feed is engaged.

A selector switch permits ready change from the underpass method of finishing gears to the transverse feed method. When the latter method is employed, the cutter-carrying table is locked in a central position, and a vertical feed is used by automatically raising the knee of the machine a fixed amount with each stroke of the reciprocating head.

A hand-lever on the front of the machine permits rapid lowering of the knee for reloading and raising again into the automatic feed position. The number of oscillations of the head is controlled by change-gears, while a limit switch controls the length of the transverse stroke.

This new machine is available in three sizes for finishing gears up to 8, 12, and 16 inches in diameter. The maximum distance between work-carrying live centers is regularly 18 1/2 inches, but by means of a special offset headstock, this distance can be increased to 25 1/2 inches.

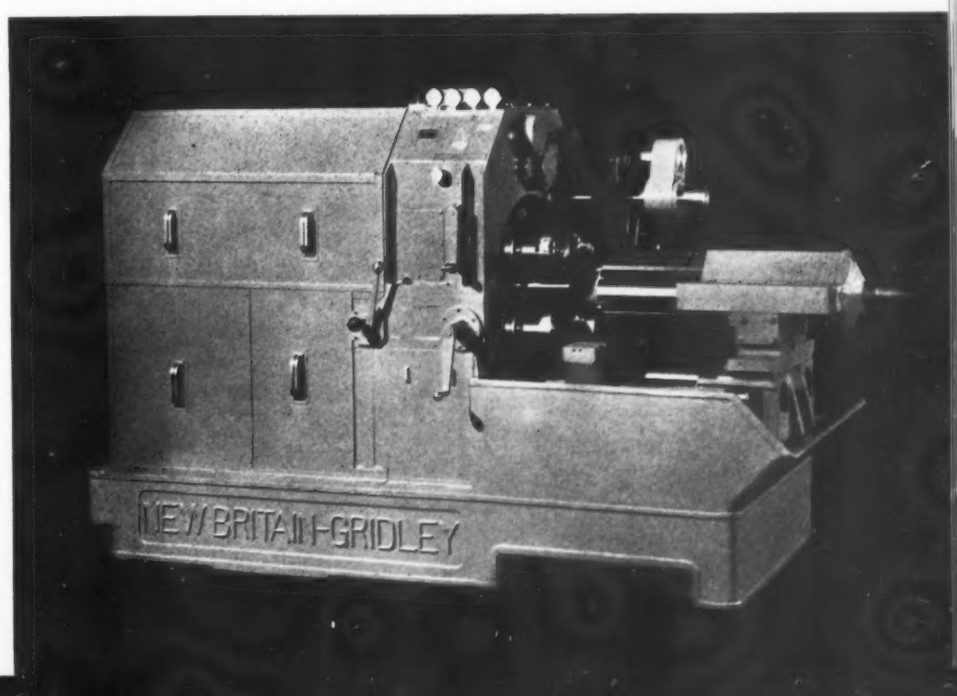


Fig. 2. Four-spindle New Britain Work-rotating Chucking Machine

Selling Machine Tools to the

By REAR ADMIRAL H. G. BOWEN
Office of the Secretary of the Navy
Formerly Engineer in Chief, United States Navy

THE United States Navy has become an important factor in the machine tool market in view of the contemplated expenditures for machine tools during the present fiscal year (July 1, 1939 to June 30, 1940). Approximately $6,500,000 will be spent by the Bureaus of Engineering and Construction and Repair for new machines for Navy Yards, and considerable additional amounts will be spent by the Bureaus of Ordnance and Aeronautics for similar purposes at the Washington Gun Factory; the Torpedo Factories at Newport, R. I., and Alexandria, Va.; and the Naval Aircraft Factory at Philadelphia.

IT is the policy of the Navy Department to purchase all equipment for Navy Yards through a central office in Washington. Requisitions and specifications for machine tools and allied equipment originate in the individual Navy Yards, but specifications are reviewed, and advertisements for bids and awards are made, by the central office. This centralized policy of buying is a distinct advantage to machine builders because it makes it easier to obtain full information regarding machines that may be required by distant Navy Yards, such as those at Pearl Harbor in Hawaii and Cavite in the Philippine Islands.

FROM the standpoint of the Navy Department, centralized buying is preferable because, with the knowledge of the different machines requested for similar operations by the various Navy Yards, it is often possible to specify a more suitable machine than an individual yard may have asked for. Also, when a number of machines of the same type are required, it is possible to combine the requirements of several yards under one specification and prepare one advertisement for bids. Another advantage is that each of the men in the central office can be assigned to write specifications to cover certain types of machines, and they consequently become more proficient than would be the case if one or two men in a Navy Yard were required to write specifications to cover all kinds of machines.

THE government policy of buying machine tools from the lowest satisfactory bidder must not be misconstrued as meaning that the cheapest machines are purchased regardless of quality. If, for example, a machine built by one concern has proved unsatisfactory in Navy Yards or private industrial plants, either because of construction defects or inaccurate performance, that machine will be considered ineligible in the placing of awards, regardless of its price. When the builder can prove that previous defects in his machine have been remedied, the machine will again become eligible for purchase.

IF a manufacturer can show that his machine possesses distinct advantages over those of competitors for the work to be performed, specifications can be written around his machine. The Navy Yard that originates the requisition, however, must logically explain the reasons for selecting a definite type of machine. In other words, all other things being equal, machines are bought on price, but they are not bought merely because they are cheap, if their purchase would handicap the production activities of the Navy Yard.

AFTER the Navy Yards have submitted requisitions to cover their needs, the preliminary specifications are discussed with the manufacturers' representatives, or they may be sent direct to manufacturers of the equip-

U. S. Navy

Rear Admiral H. G. Bowen, United States Navy, was born in Providence, R. I., in 1883, and was appointed to the Naval Academy from Rhode Island. He graduated in 1905, and was a post-graduate in engineering from Columbia University in 1914. He has been chief engineer of several ships, including the battleship Arizona, and was commended by the Secretary of the Navy in 1918 for improvements to the turbines of the Arizona. Admiral Bowen has been fleet engineer on the Staff of the Commander of the Battle Fleet and Commander-in-Chief, United States Fleet. He has had over fifteen years sea duty, and extensive experience in Navy Yards, both in repairing and building ships. He was chief production officer of the Puget Sound Navy Yard during the building of the Louisville, and on account of the record in constructing this vessel he was again commended by the Secretary of the Navy. In July, 1931, Admiral Bowen came to the Navy Department as assistant chief of the bureau of engineering. In 1935, he became Chief of the Bureau.

REAR ADMIRAL H. G. BOWEN

ment wanted if there is doubt as to the effect of and desirability of the detail requirements. If the specifications call for certain details that a manufacturer cannot supply, the opportunity is afforded for changing the specifications to suit, provided, of course, that the details in question are not important. Such cooperation between the central buying office and manufacturers' representatives results in the intelligent procurement of machine tools to best meet the needs of the yards.

MACHINE tools for the Gun and Aircraft Factories and for use aboard ship are also bought according to specifications, and awards are made in Washington by officers of the bureaus concerned. In making purchases, these bureaus follow a procedure analogous to that outlined. Steel and similar raw materials are procured on the same basis, except that when the price of the order is nominal, the Navy Yards can buy directly from the manufacturers.

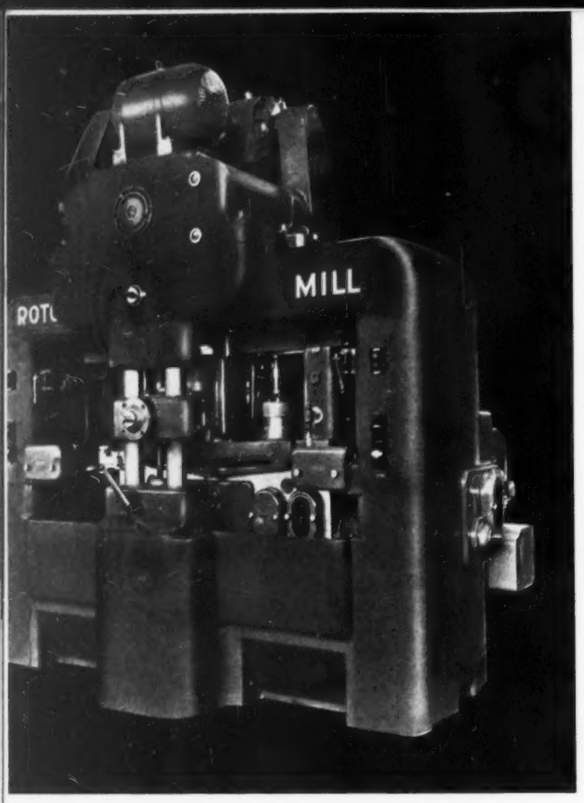


Fig. 1. Cylindrical Work is Machined by Milling Cutters in the RotoMill, Built by the National Broach & Machine Co.

RotoMill and RotoShaving Machine Built by the National Broach & Machine Co.

The recently designed Red Ring RotoMill, a machine that employs milling cutters for performing the kind of work usually done by lathe tools, has been announced by the National Broach & Machine Co., Shoemaker and St. Jean, Detroit, Mich. Another completely new machine introduced is the Red Ring RotoShaving machine, which is designed to replace "green" grinding.

The RotoMill (Fig. 1) is designed for handling any type of cylindrical, conical, or flange work, including gears, shafts, steering knuckles, and other automotive and engine parts. Artillery shells can also be handled. Machining is done at a comparatively high degree of precision, and many finished pieces do not require an additional cut.

The RotoMill cutters have from 50 to 100 teeth. The cutter load applied on one side of the work is equalized by the application of a cutter load diametrically opposite, so that heavy cuts do not deflect the work or strain the centers.

The RotoShaving machine (Fig. 2) makes use of circular shaving cutters for finishing metal surfaces. This machine can be used for work that does not exceed a hardness of 30 Rockwell. The surfaces finished with this equipment are smooth, similar to a ground surface.

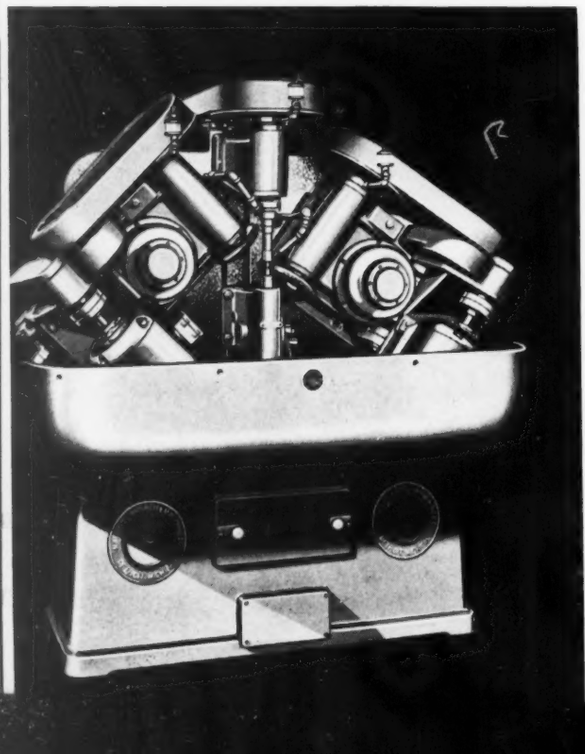


Fig. 2. RotoShaving Machine Designed by the National Broach & Machine Co. to Eliminate Grinding on Some Kinds of Work

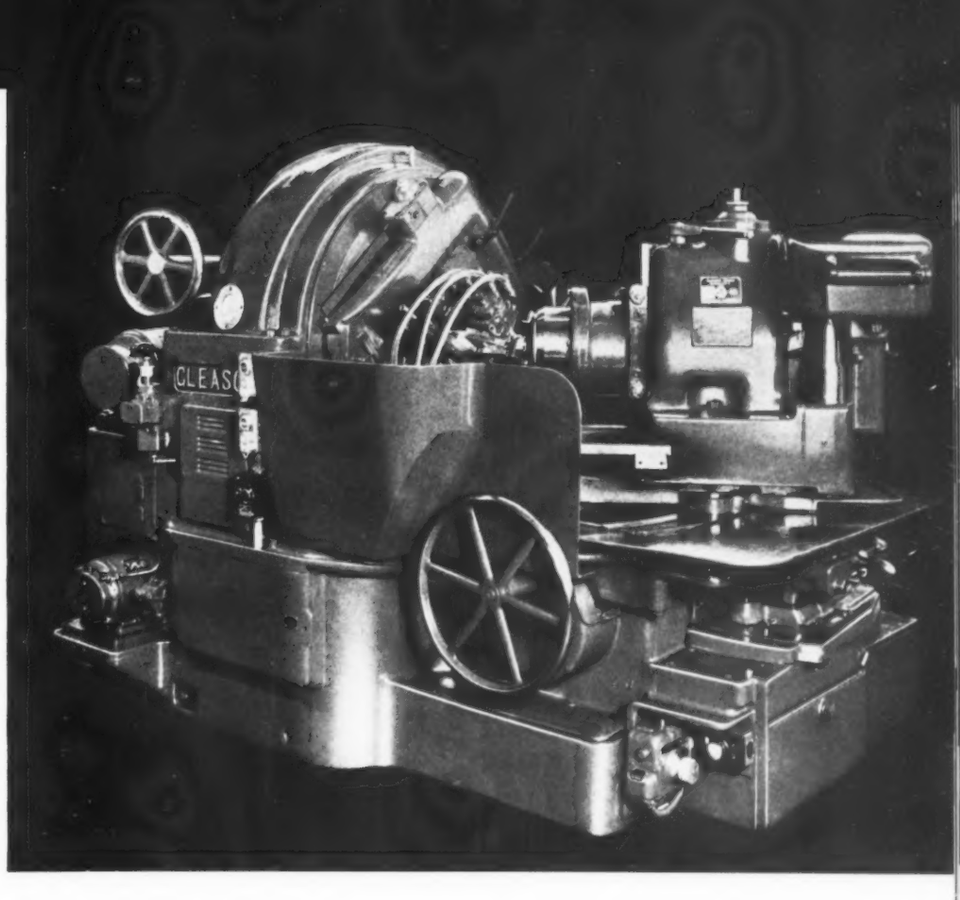
This machine is particularly useful for truing up locating surfaces to be used in subsequent machining operations, and for sizing and truing gear blanks prior to tooth cutting. From 0.010 to 0.015 inch of stock can be removed from flat flanged surfaces or approximately 0.020 inch of stock on the diameter of cylindrical and circular parts. As many as four or five surfaces can be machined simultaneously. Dimensions can be held within 0.001 inch, and the cutter life is generally about 4000 pieces per grind.

Westinghouse Line Starter, Heavy Limit Switch and Vibrometer

A new small-size across-the-line starter for capacity ratings up to 2 H.P., 220, 440, and 550 volts, two- and three-phase current, and equivalent ratings on single-phase currents, is announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These starters are adapted for across-the-line starting of squirrel-cage induction motors and for use as primary switches for wound-rotor induction motors used on machine tools, conveyors, pumps, etc. They are available in combination with motor circuit switches and "Nofuze" circuit-breakers in standard enclosures. The principal features include "De-ion" arc quenching, and snap-action bimetal-disk overload relay.

This company has recently brought out a new, exceptionally heavy limit switch for use with high-speed planers. This switch combines the cut and return limit switches in a single case. A group of new single-, two-, and three-button push-button units and several types of line starters have also been developed.

An electrical vibrometer, which measures vibration as small as 0.0001 inch in a machine member operating at a speed of 3600 R.P.M., is another new development of the company. With this vibrometer, a velocity type of magnetic pick-up is seismically mounted and held against the motor or machine being tested. The vibration output from this pick-up is read direct as amplitude on an indicating meter.



Gleason Gear and Pinion Grinder Designed for the Precision Grinding of Zerol Bevel, Spiral Bevel and Hypoid Gears

Gleason No. 15 Gear and Pinion Grinder

Zerol bevel, spiral bevel, and hypoid gears and pinions can be precision-ground on a No. 15 grinder being introduced on the market by the Gleason Works, 1000 University Ave., Rochester, N. Y. Generated tooth profiles are ground by means of a relative rolling motion between the wheel and the work. This motion consists of rotation of the cradle on which the wheel is mounted and rotation of the work on its axis. The relative motion is the same as though the gear being ground were rolling with a generating gear of which the wheel represents a tooth.

After the work is chucked and the wheel dressed, the operation of the machine is entirely automatic, the gear being fed into the wheel, the tooth ground by rolling with the wheel, and the gear withdrawn for indexing. This sequence of operations is repeated for each tooth, the machine stopping automatically when the last tooth has been ground.

The important specifications are as follows: Maximum cone distance, 9 inches with a spiral angle of 30 degrees, and 6 inches with a spiral angle of 0 degree; coarsest diametral pitch 2 1/2 with a 30-degree spiral angle and 3 with a 0-degree spiral angle; and maximum full depth of tooth, 3/4 inch.

Warner & Swasey Turret Lathe for Brass Work and Preselector

Among the several new developments brought out by the Warner & Swasey Co., Cleveland, Ohio, is an entirely new machine designed especially for brass work (Fig. 1). This machine, which has a 16 3/4-inch swing, is designed for high-speed operation. It is provided with a direct two-speed drive and an electrically operated mechanical brake. One of the features is automatic control of the two spindle speeds and reverse, which is operated by the movement and indexing of the hexagon turret. The operator simply starts and stops the machine and sets the controls. The machine will go through any cycle automatically.

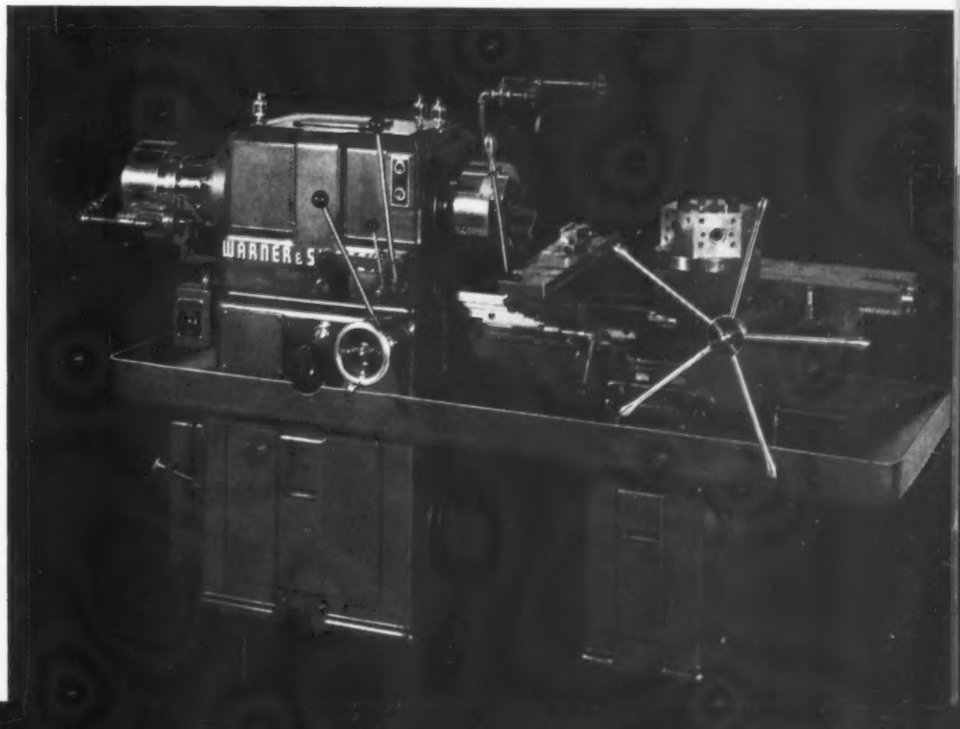


Fig. 1. Warner & Swasey Turret Lathe Designed Especially to Operate at the High Speeds Necessary for Machining Brass Work

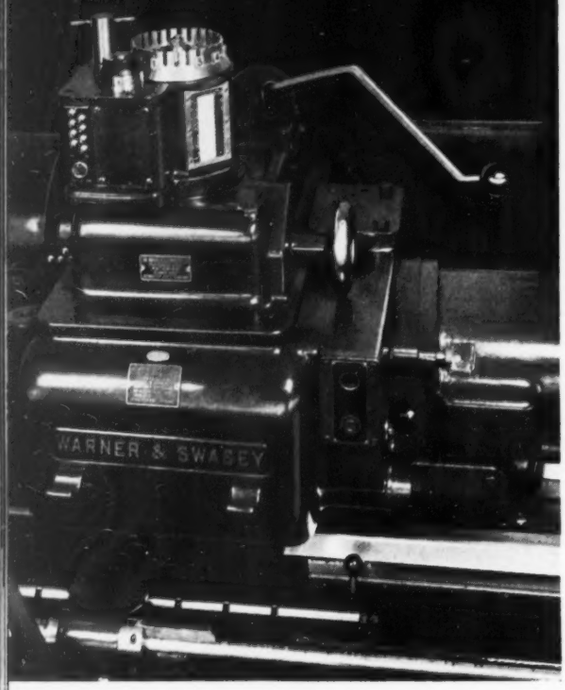


Fig. 2. Warner & Swasey Preselector, which Makes it Possible to Select in Advance a Sequence of as Many as Eight Spindle Speeds

It may be equipped with a stationary air cylinder for faster reversal of the spindle.

The company also announces an improved preselector which makes it easy to select and obtain the proper speeds. These preselectors are regular equipment on several of the Warner & Swasey machines. Speed indicators are provided on the Nos. 3A and 4A machines. With the preselector, the operator need only know the diameter on which he is working and the surface speed at which his cuts are to be taken. The preselector automatically gives him the proper spindle speed and the operator can then obtain that speed with a single lever shift.

Another new preselector, shown in Fig. 2, is known as the "New Program" preselector. This makes the cycle of speeds automatic. After the job has been set up with the proper speeds, the unit can be locked. The device automatically selects the necessary speed while a cut is being taken. In this way, any number of speeds up to eight can be selected and "locked" into the mechanism.

A preselector apron to apply the preselection principle to feeds, as well as to speeds, is also being developed. While not yet applied to the company's turret lathes, it shows the trend of turret lathe design and indicates what refinements may be expected in the future.

Van Norman Ram Type Universal Milling Machines

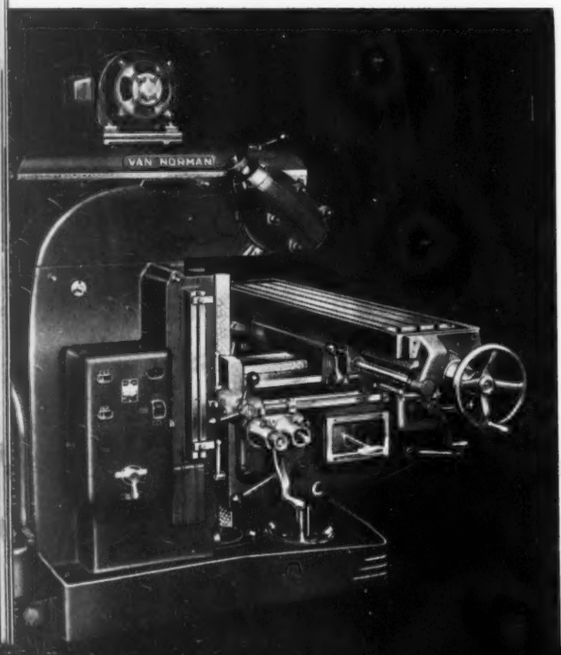
Two ram type universal milling machines (Nos. 26 and 36) have been announced by the Van Norman Machine Tool Co., Springfield, Mass. The machines are of completely new design and are alike, except for size, the No. 26 being equipped with a table 50 by 12 inches, and the No. 36 with a table 58 by 13 inches.

The ram is larger and of heavier construction than previous models; the gear transmission has heavier gears, and they are mounted on spline shafts that revolve in ball bearings; the speed-change unit provides eighteen speeds, ranging from 30 to 1500 R.P.M.; the cutter-head is more rugged and has a greater bearing surface on the ram; the cutter-spindle is hardened and ground and is equipped with double opposed Timken bearings on the front end and ball bearings on the rear end; and the ram type over-arm, which is 43 inches long, has a double taper bearing on the ways to provide a rigid outboard support.

The knee contains the entire feed-change transmission unit, which is operated through a vertical multi-spline drive-shaft from the driving unit in the base and column. Eighteen feeds are obtainable through one lever. A front and rear control are provided for the direction of the saddle and knee feeds. There is a rapid traverse in six directions of table, knee, and saddle travel, also controlled through levers at the front and rear of the machine.

Bliss Press Brake

The E. W. Bliss Co., 53rd St. and 2nd Ave., Brooklyn, N. Y., is adding to its line of all-steel press brakes a new machine that has a capacity for handling mild steel 1/2 inch thick by 12 feet long. The side housings of this machine are made from cast steel, and the slide and bed are



(Left) Van Norman Ram Type Universal Milling Machine of New Design from Base to Over-arm

(Right) Bliss Press Brake of 1/2-inch by 12-foot Capacity

made from rolled-steel plate. The Bliss gear reduction unit can be adjusted for any speed from ten to twenty strokes per minute, as required by the operating conditions.

The machine is controlled through the action of a hydraulic clutch of new design and push-button control for inching and stopping at any point of the stroke. The clutch can also be controlled by means of a foot-treadle arrangement, which can be tilted up out of the way, so that it is impossible to trip the brake with the foot-treadle while the machine is arranged for hand operation. It is possible to change quickly from hand control to foot control.

An overload protecting device stops the machine in case it is subjected to an unusually heavy load. The drive from the motor to the flywheel is by V-belts. The width of the slide is 14 inches from front to back, and the width of the bed 16 inches front to back. The height from the floor to the top of the bed is 32 inches, and the weight approximately 110,000 pounds.

Dawes Automatic Centrifugal Clutch

A new positive-acting automatic centrifugal clutch for use on all types of industrial power drives is being placed on the market by Dawes Equipment, Inc., 2280 Penobscot Bldg., Detroit, Mich. This clutch has no metal wearing surfaces and requires no lubrication. Tests over a period of two years, under severe starting and stopping, and heavy-duty operating conditions, with all kinds of driving motors, are said to have left the clutch practically free from harmful wear.

The clutch consists essentially of two main parts—the housing drum, or driven member, and the expansion body or driving member. A steel cover-plate held in position by means of a lock-ring seals the clutch mechanism against dust, etc. The expansion body consists of six metal segments interconnected by tension springs and operating on individual posts extending radially from the driving hub. Six standard sizes cover a range of 1-inch up to and including 2 3/8-inch diameter shafts and horsepower capacities ranging from fractional sizes up to 125 H.P.

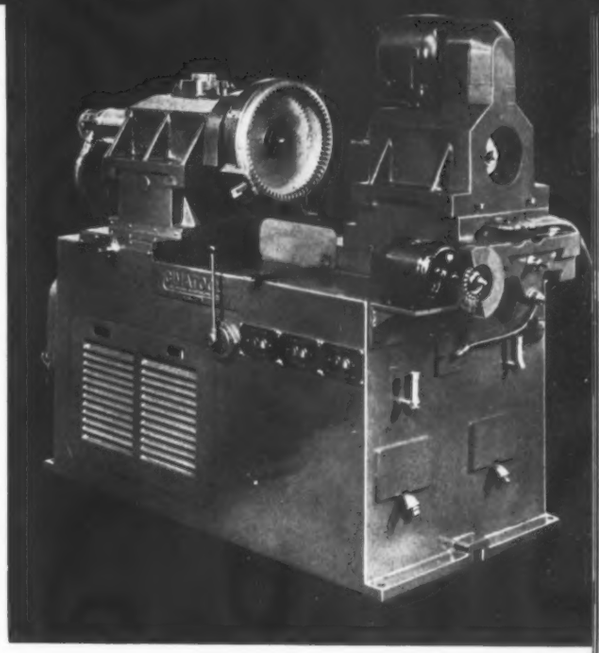


Fig. 1. Contour Burring Machine Recently Placed on the Market by the Cimatool Co.

Cimatool Gear-Tooth Chamfering and Contour Burring Machines

Among the new machines brought out by the Cimatool Co., Dayton, Ohio, is the No. 103 1/2 C gear-tooth chamfering machine shown in Fig. 2. This machine has two work-heads and two cutter-spindles, so that two gears can be chamfered simultaneously or one gear can be chamfered while the other is being loaded. The cutter-head accommodates either pencil cutters or hollow-mills. In changing over from one job to another, nothing but an adapter is required, provided the pitch of the new gear is the same; otherwise, a master drive gear of the same pitch as the new work must be provided. The machine is especially economical for short runs when the change-over time from one job to another is of importance.

Fig. 1 shows the company's No. 201-A contour burring machine which is built to automatically burr the ends of either external or internal gear teeth over their entire profile—top, sides, and root. This machine is especially useful for large ring gears, aircraft gears, etc. It has one cutter-spindle which carries a pencil cutter, formed according to the type of tooth being burred. The cutter-spindle, while adjustable for positioning, remains fixed in operation. The work-spindle head which carries the gear, hydraulically located and clamped, operates with three simultaneous distinct motions—that is, transverse, forward and backward, and rotary. The resultant of these three motions presents the end profile of each tooth to the pencil cutter. After the gears are machined on the forward face of the teeth, a single resetting is all that is required for machining the rear face.

The various motions of the work-head are controlled hydraulically by means of simple cams. A change-over merely requires a change in the cams and adapters, together with a change in drive gears, if the new job has a different number of teeth from that last performed.

Fig. 2. Cimatool Gear-tooth Chamfering Machine Equipped with Two Work-heads and Two Cutter-spindles

J. R. WEAVER

How Can We

James Riley Weaver, Director of Equipment, Inspection and Tests for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was born in Irwin, Pa., in 1895. After serving a machinist apprenticeship with the Westinghouse Air Brake Co. at Wilmerding, he became a tool designer with the Westinghouse Machine Co. in 1915. During the World War, he served in the United States Navy with the commission of ensign. He then returned to the Westinghouse Machine Co. as assistant superintendent of tools and equipment. Later he became assistant mechanical engineer for the Westinghouse Electric & Mfg. Co., and has since held the positions of works mechanical engineer, assistant superintendent of equipment, superintendent of manufacturing equipment, and works equipment director, until, in 1936, he was appointed to his present position as director of equipment, inspection and tests. Mr. Weaver is a member of the American Society of Mechanical Engineers, and is active in several important committees. He is also president of the American Society of Tool Engineers.

By J. R. WEAVER
Director of Equipment, Inspections and Tests
Westinghouse Electric & Mfg Co.
East Pittsburgh, Pa.

THE machine tool designer, in most instances, has so successfully solved the problem of providing machines that will give the utmost in cutting performance of which the cutting tool materials known today are capable that from now on his efforts can, to advantage, be turned in a somewhat different direction. On most machine tools little can be gained by trying to obtain faster cutting than the present machines are capable of; but on many machines there is considerable loss of time between cuts. It is the idle time between cuts that presents a problem to the machine tool builder and offers the designer an opportunity to reduce still further the production costs of the machine tool user.

Reduce Idle Machine Time?

ONE frequently finds that a machine operator prefers a certain make of machine. Upon investigation, it is usually found that the reason for his preference is that when he works "piece-work" he can earn more with this make of machine—it is easier to operate, the speeds and feeds are more easily changed, or the chucking, clamping, or setting up of the work, fixtures, or tools is easier.

IN one instance, we had two competing machines put in operation in the Westinghouse plant. They were apparently of equal workmanship, and were equally sturdy and capable of performing the work. As far as general design goes, they were equally well executed; yet the operators immediately showed preference for one of these machines. The reason was simply that it was possible to keep one machine cutting a greater part of the time than the other—the machine earned more money for the operator, and, incidentally, of course, more money for the firm. This comparison has been noted in the case of many different types of machines. There are even instances where one machine may be superior as regards accuracy and life than the other; and yet, from a production point of view, the somewhat inferior machine may be the more economical, because in its design, thought has been given to cutting down the idle time to the utmost.

CONSIDERING, first, the smaller types of machines—turret lathes, milling machines, and the smaller sizes of boring mills —it might be advisable to conduct actual motion studies in deciding upon design features. It may be found that, by changing the locations of levers and handwheels, and by the use of different kinds of clamping means, tooling arrangements, etc., the idle time can be reduced. After all, the machine performs its real work and earns money for the user only when the tools are actually cutting.

IN the case of larger machines, such as big boring mills, planers, and large milling machines, which represent a very large investment, the idle time is even more important. It is not unusual that on these large machines the setting up of the work and tools requires so much of the time that the machines are actually cutting only from 20 to 30 per cent of the floor-to-floor time. When a machine costs, say, from $50,000 to $100,000, it is easy to see that even a 10 per cent increase in actual cutting time would make a great difference in the earning capacity of the machine.

THEREFORE, in the design of these machines, many factors that are not directly related to the cutting performance of the machine should be considered, such as, for example, how the work is brought to the machine and placed in the operating position, how it is set up and clamped, how the tools are clamped and adjusted, and what means could be provided to reduce the time for any or all of these operations. In this connection, it is well to emphasize that the customer's plant is the real laboratory for the machine tool builder. This applies to most types of machinery, but it is probably especially true in the case of machine tools.

IN conclusion, it should be emphasized that because of present wages, shorter workhours, and high taxes, it becomes necessary to produce more in a given time, if industry is to continue to function without undue price increases, which, in turn, would mean increased living costs. The effectiveness of human effort in a given time must be improved. In machine tool operation, the most obvious direction in which this can be done is by cutting down the idle time.

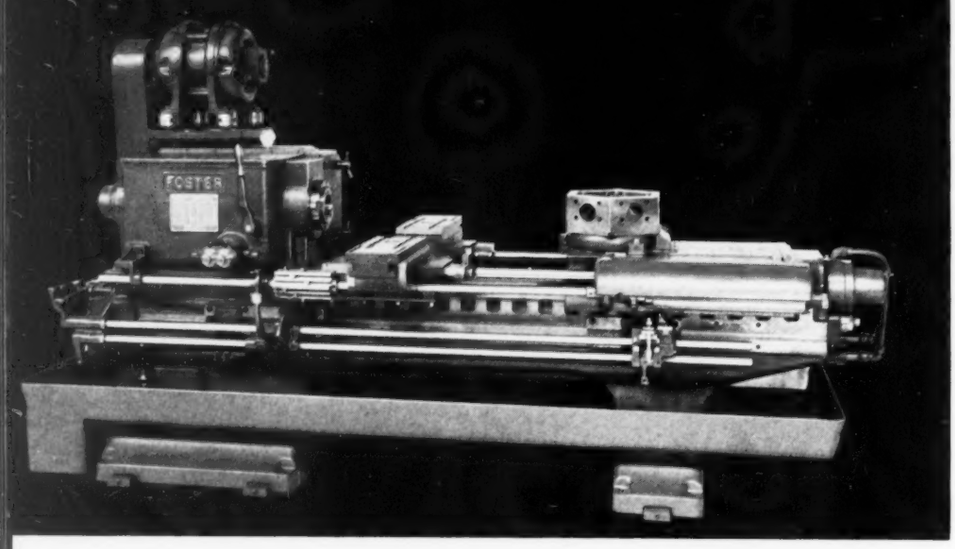
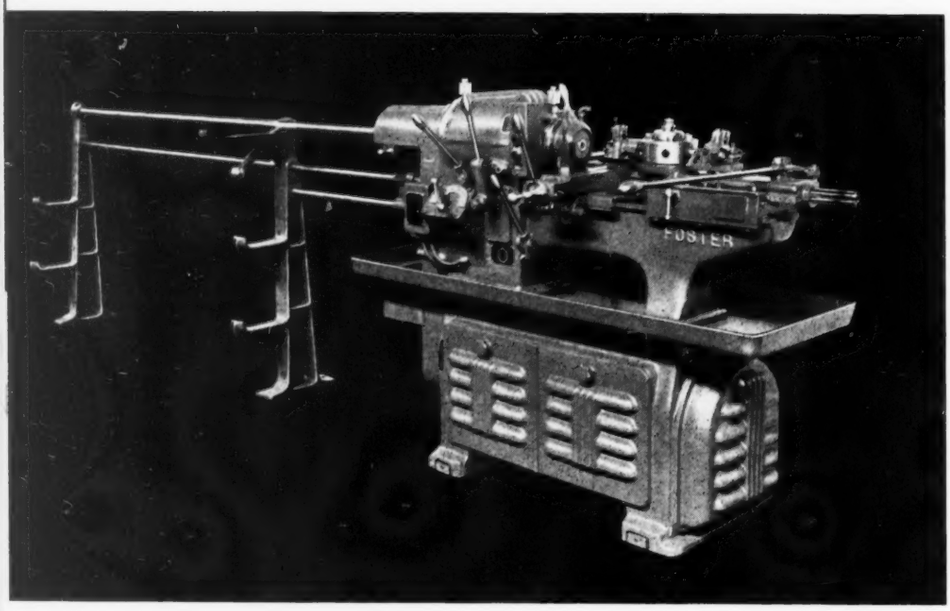
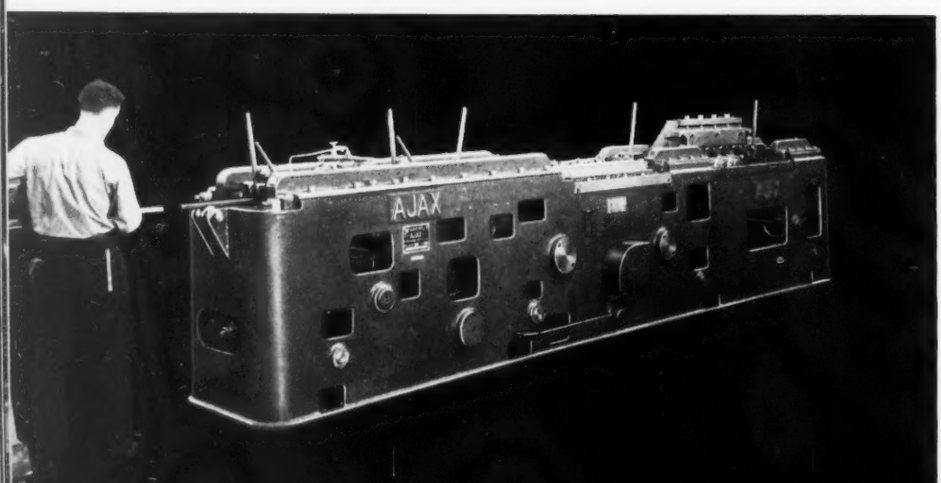


Fig. 1. (Above) New Fastermatic Machine with Twenty-eight Speed Changes. Fig. 2. (Below) Foster Improved No. 1 Motor-in-the-base Screw Machine



(Below) Ajax Continuous Cold-drawing and Straightening Machine in which Cold-drawn Bars are Produced Accurately to Size and Commercially Straight



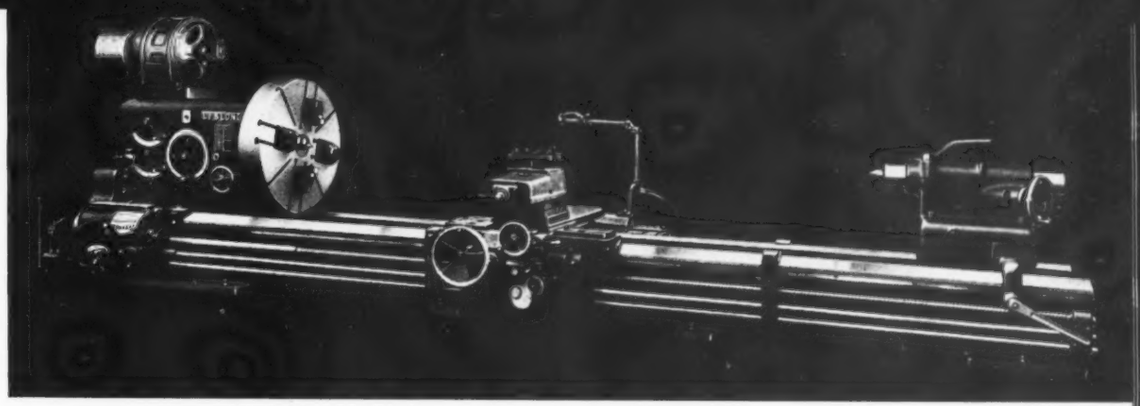
Foster Improved Fastermatic and Screw Machine

A number of changes have been incorporated in the design of the 2-F Fastermatic shown in Fig. 1, built by the Foster Machine Co., 902 Foster Bldg., Elkhart, Ind. The head now has twenty-eight changes of speed, from 17 to 263 R.P.M. Higher speed ranges are possible, if desired. These changes are arranged in seven sets of four automatic changes. Any group of four automatic changes can be quickly selected by the use of pick-off gears. An ingenious arrangement is introduced for the automatic change of spindle speeds to suit the tools in the turret. The changes can be made any time during the cut or at the end of the stroke. It is possible to have all four automatic spindle speed changes during one forward movement of the turret, or with every forward movement of the turret. This arrangement for automatic change of spindle speeds obviously reduces the machining time to a minimum, as each operation is performed at the right speed.

Several improvements are included in the Foster No. 1 screw machine, Fig. 2. It has the high spindle speeds required for modern cutting alloys. Almost instantaneous changes between high and low spindle speed ranges are available for turning and threading. This, with the rapid power-operated automatic chuck and bar feed, facilitates the rapid production of small parts. The spindle drive is entirely gearless from a motor in the base, making for quiet and smooth operation.

Ajax Continuous Cold-Drawing and Straightening Machines

Cold-drawn bars are produced accurately to size and commercially straight, ready for automatic screw machines and other applications, in one pass through continuous drawing and straightening machines now being placed on the market by the Ajax Mfg. Co., Cleveland, Ohio. In the operation of one of these ma-

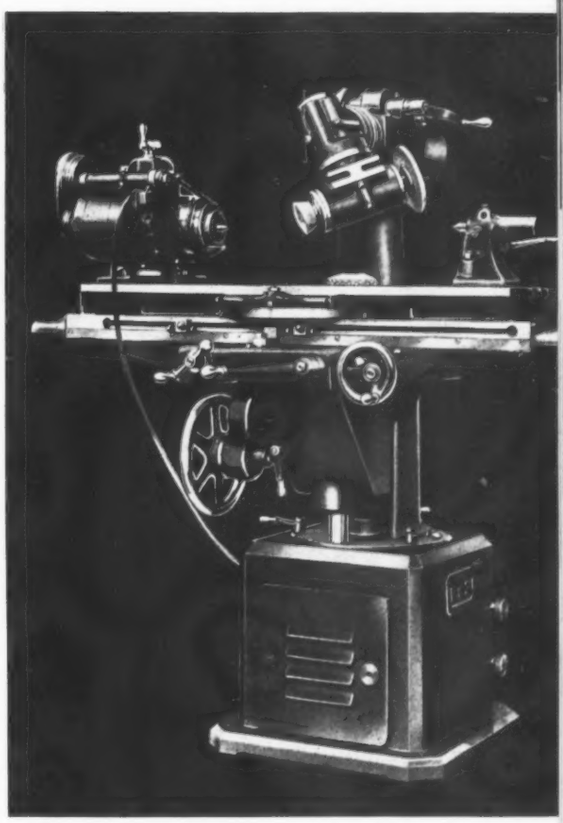


chines, which constitute a new development in the cold-drawing field, a hot-rolled, pickled, and limed bar, or a hot-rolled blast-cleaned bar, is first started into an inching slide. Grips on this slide start the bar through the drawing die without requiring any preliminary pointing operation.

When it has passed through the drawing die, the bar is gripped by the first drawing slide and after advancing, passes into grips of a second drawing slide. The bar is then pulled at a uniform speed through the drawing die by hand-over-hand operation of the two drawing slides. As one slide pulls the bar, the other returns. The pulling strokes overlap, so as to keep the bar always in motion.

The bar is then pushed through the horizontal straightener before any appreciable age hardening takes place. It then passes through a feed-slide and is pushed through the vertical straightener, after which it passes through the last feed-slide. When the trailing end of the bar has passed out of the drawing slides, the feed-slide grips and feeds it out of the machine on a run-out table. All straightening rollers are readily adjustable to permit the use of rollers that have been redressed a number of times.

Fig. 1. (Above) LeBlond 48-inch Heavy-duty Lathe of Completely New Design



LeBlond Lathes and Cutter Grinders

Three completely redesigned machines have been placed on the market by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio—a 48-inch heavy-duty lathe, a "Super Regal" lathe, and a No. 3 cutter grinder.

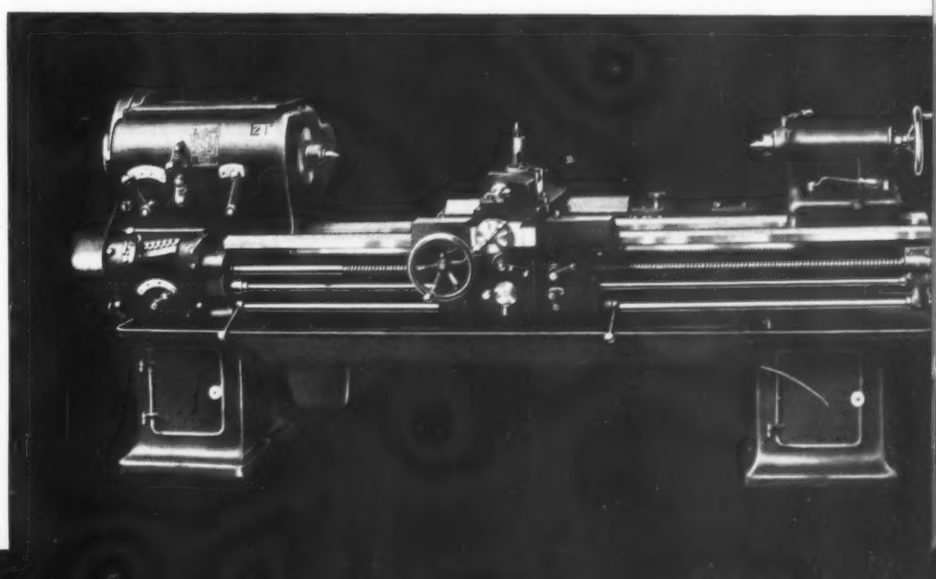
The 48-inch heavy-duty lathe (Fig. 1) has fifty-four selective feeds obtainable without changing gears. The quick-change box is sealed in an oil-tight casting. The tailstock spindle is hollow-bored to allow bar stock to be passed through. A geared taper attachment provides for cutting tapers from 0 to 6 inches with a maximum turning length of 25 feet at one setting. The attachment can be arranged for obtaining a combined cross-length feed. The power rapid traverse moves the carriage to and from the working position at the rate of 20 feet per minute.

The 21-inch "Super Regal" lathe is shown in Fig. 3. This lathe is also built in 13-, 15-, 17-, 19-, and 24-inch sizes. All but the 21- and 24-inch sizes have a speed selector built into the headstock, which is equipped with a dial that indicates the cutting speed for commonly machined materials and the corresponding R.P.M.

Eight spindle speeds are obtainable through sliding gears, the final drive being through helical gears. A direct motor control or multiple-disk clutch and brake are furnished on the 21- and 24-inch lathes when frequent and rapid starting and stopping are required. A single point adjustment enables the plates to be adjusted as little as 0.003 inch, a feature said to provide maximum capacity with minimum pressure on the operating lever.

The No. 3 cutter grinder (Fig. 2) is provided with a universal wheel-head that has three independent and coordinated planes of full circle movement, thus providing unusual versatility and flexibility. Work can be placed in any position relative to the grinding wheel. The work-head is driven by an independent two-speed unit.

Fig. 2. (Above) Universal Cutter Grinder Designed for Unusual Versatility and Flexibility. Fig. 3. (Below) "Super Regal" Lathe Built by the R. K. LeBlond Machine Tool Co.



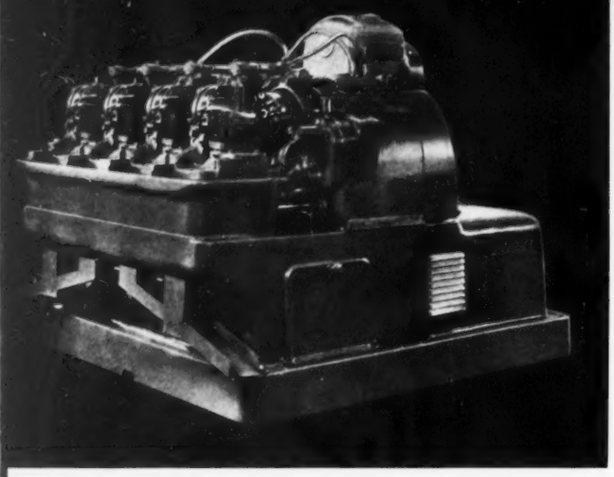


Fig. 1. Landis Threading Machine which Produces 1900 Hollow-head Set-screws per Hour

Landis Four-Spindle Semi-Automatic Threading Machine

Hollow-head set-screws can be threaded at the rate of 1900 screws per hour on a new four-spindle semi-automatic threading machine developed by the Landis Machine Co., Inc., Waynesboro, Pa. Flexibility of design is the keynote of this machine. It is strictly a production tool.

Even at the rate of production mentioned, the actual cutting speed will be less than 35 circumferential feet per minute. This slow cutting speed insures threads of good quality and a long chaser life even when the material being threaded is tough heat-treated alloy steel.

The indexing turrets employed in threading hollow-head set-screws can easily be replaced with holding fixtures for use in threading bolts or special parts. Also, a gripper mechanism can be substituted for the turret, or a work-holding fixture can be used to suit the threading of long rods or bars.

The double-head machine illustrated in Fig. 2 was recently equipped, as shown, for a combination pointing, beveling, turning, and facing operation. This is a standard Landis 7/8-inch threading machine provided with lead-screws and with 7/8-inch Lanco hardened and ground heads of regular design.

The special equipment includes milling cutters which replace the usual chasers, a spring-actuated tool-holder for carrying the pointing and beveling tool (two of these special tools are shown on the right-hand carriage of the machine), and an automatic stop for positioning the work in the vises. Special milling cutters can be used for reducing the body diameters of long bolts; or cutters for a combination turning and shoulder-facing operation can be substituted for the regular milling cutters.

The pointing and beveling tools are carried in a holder that extends entirely through the spindle. This tool-holder can be adjusted at the rear of the spindle to permit the turning, pointing and beveling of work for a length of 5 inches. The four milling cutters operate in a single plane about the axis of the work when in use.

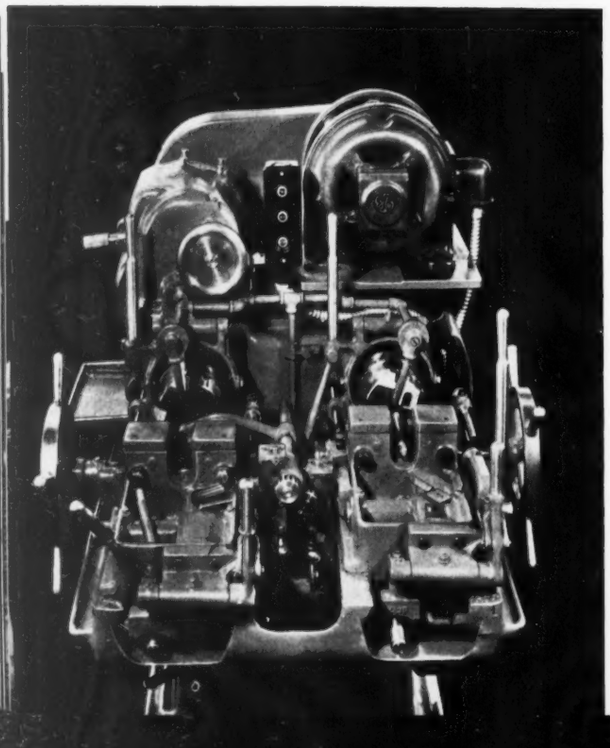


Fig. 2. Landis Threading Machine Equipped for Turning Operations

Doall 26-Inch Throat Machine

A Doall contour shaping machine with a throat depth of 26 inches has been brought out by Continental Machines, Inc., 1301 Washington Ave., S., Minneapolis, Minn., to supplement the 16- and 36-inch throat machines of its line. Like the previous models, the new size is of arc-welded construction and presents a streamlined appearance. It is equipped with a 30- by 30-inch work-table. The table can be inclined forward, toward the rear, or sidewise at any angle up to 45 degrees, by means of a hand-operated screw.

Twenty-six-inch Throat Machine Added to Doall Line

On the new machine, band saws of any width from 1 millimeter up to and including 1 inch can be used, whereas the previous models accommodated band saws up to 1/2 inch wide only. The new machine will also take a 1/2-inch wide file band, in addition to the 1/4- and 3/8-inch bands.

An automatic power work-feed exerts pressure toward the saw throughout the cutting of the contour. Any curve can be cut without the application of hand pressure. Speeds from 50 to 1500 lineal feet per minute are available, the exact speed being indicated on a dial.

The Micromatic Hydrohoner

A new machine brought out by the Micromatic Hone Corporation, 7401 Dubois St., Detroit, Mich., known as the "Hydrohoner," employs new combinations of mechanical and hydraulic controls. It can be used not only in finishing bores, but also on external cylindrical surfaces where the work can be rotated for the honing operation.

"Hydrohoner" Introduced by Micromatic Hone Corporation

The machine has a wide range of speed combinations, both for rotating and reciprocating the spindle. The relatively high-speed abrasive motion thus produced is combined with the low-speed reciprocating movement of the work, which is chucked or loaded in a fixture and mounted on the hydraulically actuated work-table. In operation, the work is moved up automatically to the working position, and the table is slowly reciprocated as the spindle rotates and reciprocates. The spindle stroke is varied by remote control.

The range of spindle stroke varies from 0 to 1/2 inch, and of table stroke from 1/2 inch to 8 inches. The actual honing time in usual applications is only a few seconds per piece, so that high production is obtainable. Surface smoothness within 5 micro-inches can be produced on most types of work, and in some instances, a smoothness of less than 2 micro-inches has been obtained. Hone bodies are available for every 1/32 inch increase in bore diameter. All hone bodies are interchangeable on the machine and are made with ball-retaining mechanism to facilitate quick interchange.

Fig. 1. Cincinnati 24-inch Heavy-Duty Type Rapid-traverse Shaper

Cincinnati Shapers and Shears

The Cincinnati Shaper Co., Cincinnati, Ohio, has made several improvements in its line of shapers and shears. The 24-inch heavy-duty rapid-traverse shaper (Fig. 1) is provided with faster and more convenient controls than have formerly been available, power rapid traverse, multiple cam feeds, direct-reading dials, and automatic oiling.

The shears as now built feature new developments in electric gaging, which make for increased production. Fig. 2 shows the No. 1410 shear with hydraulic hold-downs that automatically clamp any thickness of metal with the same pressure; fine adjustments for the four-edge knives, increasing the cutting efficiency and giving longer life; and rapid gaging means that speed up the handling of the work. All standard sizes of shears are available from No. 10 gage to 1 inch.

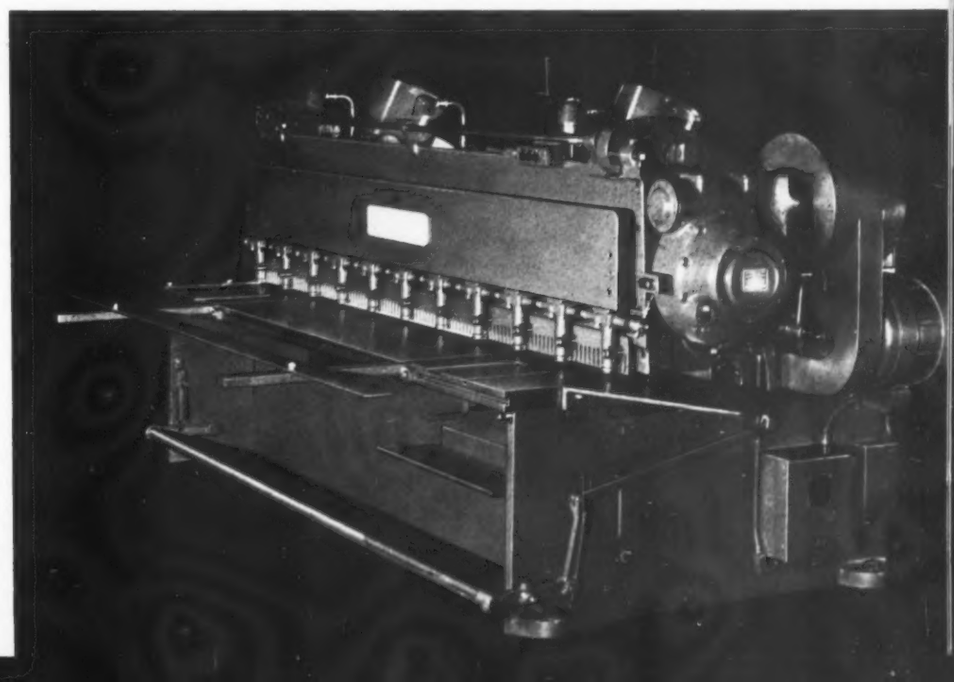


Fig. 2. Cincinnati All-steel Shear with Hydraulic Hold-downs

Greystone Studios, Inc.

DAVID A. WALLACE

Future Trends in

By DAVID A. WALLACE

President, Chrysler Sales Division
Chrysler Corporation, Detroit, Mich.

David A. Wallace, president of the Chrysler Sales Division of the Chrysler Corporation, was born on a farm in Kansas. He went to work at an early age, attaining a well rounded practical experience in many branches of manufacturing. During the World War, he served in the Army, returning from the service with the rank of captain. His success as a manufacturing executive of the John Deere Tractor Co. attracted the attention of K. T. Keller, now president of the Chrysler Corporation, and resulted in Mr. Wallace's joining the Chrysler organization as master mechanic. He soon became vice-president in charge of manufacturing of the Chrysler Sales Division. At this time, he became interested in Superfinish, a process which, under his direction, has been developed until it is now used extensively in the Chrysler plants. In 1937, Mr. Wallace became president of the Chrysler Sales Division.

TO predict the developments in surface finishes and in the machine tools to be used and the methods of measurements to be employed during, say, the next ten years, one has only to look back and note the great improvements that have been made in surface finishing methods in the last five years.

IN considering the subject of surface finishing, there are five factors that demand attention: (1) The process of finishing—that is, the various methods now in use or being contemplated, including hand finishing, which produces fine finishes at high cost; machine finishing, which is by far the most generally used process today; and the very recently developed electric or chemical methods. Doubtless, during the immediate future, the machine method will remain the basic surface-finishing process. (2) Machines for surface finish, which must be simple, rugged, and universal in application. (3) Tools for surface finish, which will continue to be mainly of the chip-producing type, such as steel tools and abrasive wheels and blocks, rather than the chipless types which will be used only for producing the highest finishes for bearing and load-carrying purposes. (4) Cost of surface finish, which should decrease as the finishing operations become fewer in number, with the final finishing operation requiring but a few seconds of time. (5) Control of surface finish quality, which is an important factor, because a surface finish, to be commercially acceptable, must be controllable—that is, in mass production operations, all parts produced over a

Equipment for Surface Finishing

period of time should have equal surface characteristics. Also, the finish of similar parts made in widely separated plants should be as nearly alike as possible.

THE measuring of fine surfaces is a development that will progress rapidly during the next ten years. The difficulty of measuring fine surface lies in the fact that surface quality is a condition rather than a dimension, and the placing of a definite numerical value on a condition is more difficult than stating a dimension. The measurement of fine surface finishes will probably involve a combination of several methods, each measuring a characteristic important to the final evaluation; the measuring methods will doubtless be made up of a combination of mechanical and metallurgical means.

UNDER the head of mechanical methods, we will have: (1) Testing equipment that will evaluate surface finish by its non-wearing qualities. (2) Testing machines based on friction that will, of necessity, have two divisions—one dealing with dry friction (used for parts of the non-lubricated type), and the other with fluid friction, used for lubricated surfaces. (3) Surface fatigue measurements by which the varying fatigue-resisting results obtained from different types of surface finish will be evaluated. (4) Measurements considering lubrication characteristics, which will become highly important, since the majority of all surface finishes are used for load-carrying bearings which must be lubricated to reduce friction. This field of measurement will doubtless be most highly developed, since portable equipment can be produced to determine surface quality from a lubrication standpoint.

METALLURGICAL or physical means for measuring surface finish quality have been in use for a number of years. It has only been recently, however, that these methods have received the attention they deserve. They include: (1) Measurement of profile—the actual profile can be reproduced as an enlarged drawing, or the average of the surface irregularities can be given a definite numerical rating. (2) Microscopic analysis, taking the form of either observing the surface through a microscope or taking photomicrographs at relatively low magnification, say, 25 to 50 diameters. A more elaborate method produces photomicrographs of the actual profile at much higher magnification, say, 750 to 1000 diameters. (3) Chemical analysis, in which the corrosive or rust-resisting properties of fine surfaces will be measured as an indication of surface quality in installations where corrosion is a factor. (4) Scratch and abrasive hardness tests, in which surface quality is measured by the resistance of the surface to scratching or deformation. (5) Electron diffraction grouping—in which method, which is of necessity highly scientific, surface quality is determined by the bombarding action of electrons and the measurement of the resulting pattern as the electrons are deflected from the surface being measured.

IN the final analysis, the quality of the surface must be measured and not the defects of the surface. It is likely that mechanical methods of measuring fine surfaces will be developed as friction measurements, using the pendulum as the basis to indicate the quality of the surface.

RECENTLY, a great deal of effort and money have been put into the development of Superfinish. As the facts about Superfinish become more generally known, a surface-finish consciousness is developed in the mechanical field, which, in the next few years, will result in definite improvements in surfaces and in the methods of measuring finishes, together with a nomenclature and a scientific basis for processes that heretofore have been regarded as shop practice arts, but are now rapidly becoming a science.

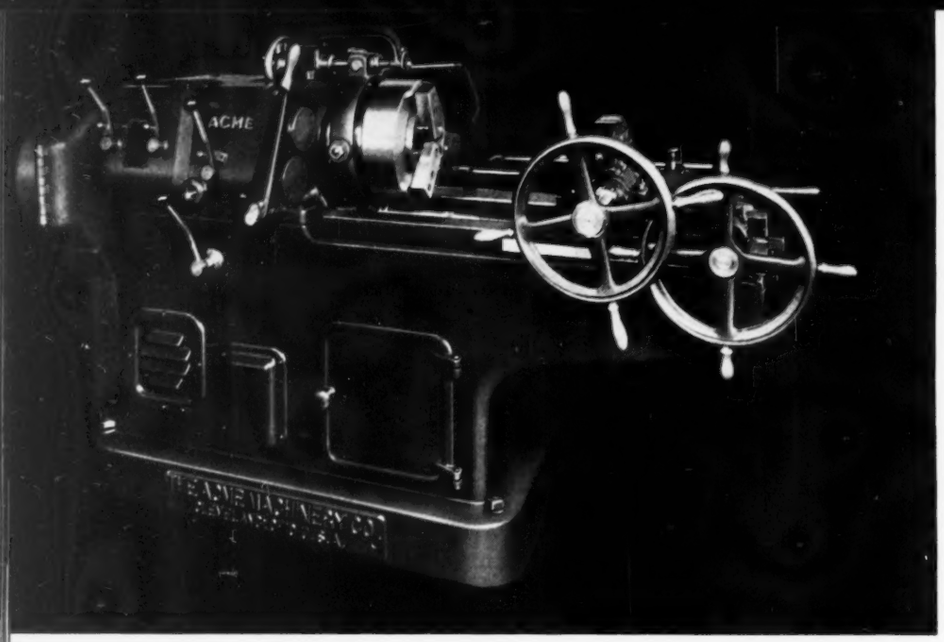
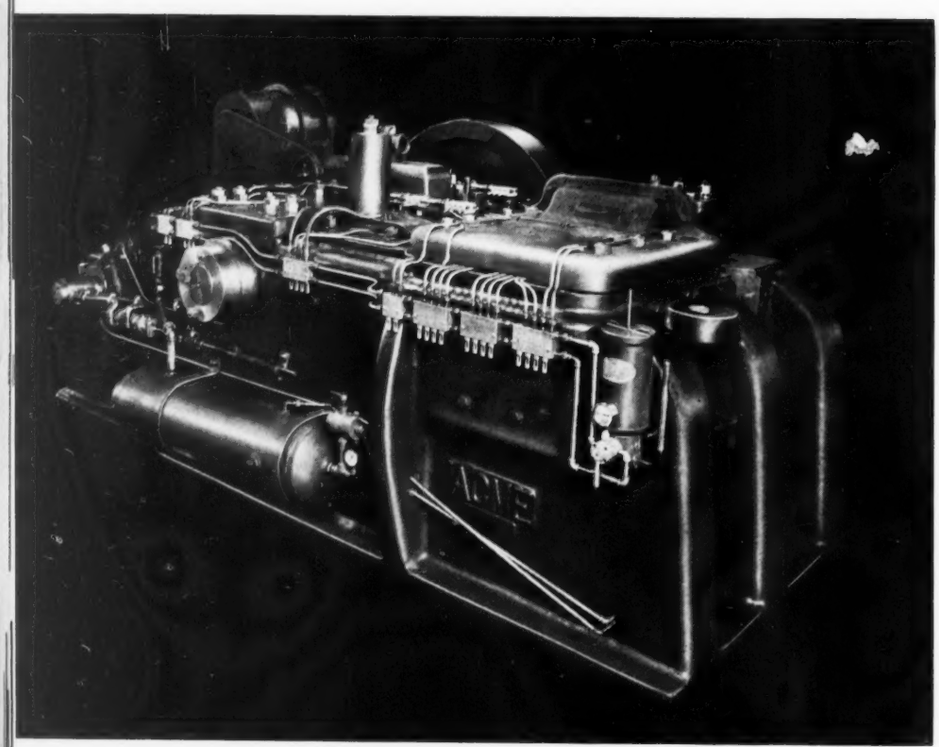


Fig. 1. (Above) Acme Roll-threading Machine that Produces Threads of Any Length on Bars up to 1 1/2 Inches Diameter. Fig. 2. (Below) Acme Model XN Forging Machine



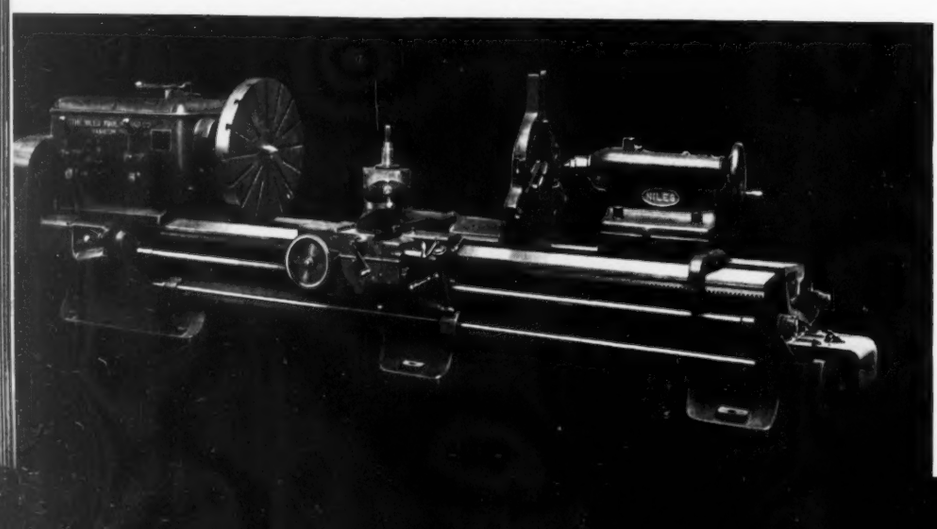
Acme Roll-Threading Machine and Forging Machine

Threads of any length can be rolled in bar stock up to 1 1/2-inch diameter by a Model XR roll-threading machine to be introduced by the Acme Machinery Co., 4533 St. Clair Ave., Cleveland, Ohio. The adjustment from one size of stock to another is quickly accomplished. The principle of this machine (Fig. 1) is different from the conventional type of roll-threading equipment in that the work is held stationary while the die rolling head revolves. This permits the stock to lead itself through the die-head. The length of thread that can be rolled is limited only by the length of the bar stock.

It is claimed that the form of thread, pitch diameter, and lead of threads rolled in this machine are unusually accurate. The burnishing action of the rolls in forming the thread gives the finished product the appearance of a ground thread. A slight surface hardness is also imparted to the thread, and strip tests have shown an appreciable increase in strength over cut threads.

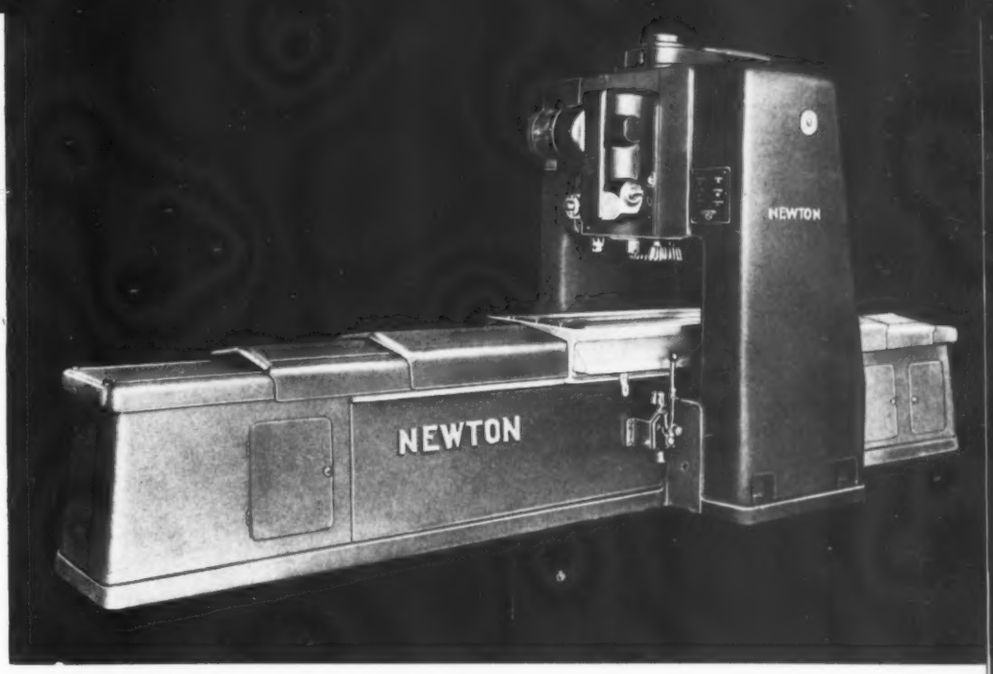
Another new machine that has been recently brought out by the company is the 2-inch Model XN forging machine which is illustrated in Fig. 2. The features of this machine include an eccentric shaft and sliding head movement; long extended header slide; double cams; double toggles; and cushioned drive. Additional die depth and greater rigidity have been provided, and the gripping dies are now backed up at two points through their entire height.

(Below) Niles 30-inch "Time Saver" Lathe with Multiple V-belt Drive



Niles "Time Saver" Lathe

The Niles Tool Works Division of the General Machinery Corporation, Hamilton, Ohio, has recently developed a 30-inch "Time Saver" lathe of modern design. The drive of this lathe is through multiple V-belts from a motor mounted on an adjustable base at the rear. All headstock gears are hardened and ground, and the spindles and all shafts are com-



Newton Mill-N-Shaver in which a Shaving Cut is Taken as the Work Returns from the Rough Milling Cut

pletely equipped with anti-friction bearings.

The apron is unusually compact to allow the operator to stand close to the work and tools. The apron is also equipped throughout with anti-friction bearings, and is provided with positive fine-tooth clutches that enable the feed to be disengaged instantly. Forty-eight feeds ranging from 1/64 to 1 inch, and speeds from 3.94 to 232 R.P.M. are available.

Newton Straight-Line Mill-N-Shaver

A machine that employs a milling cutter for rough milling work and a shaving head for producing an unusually smooth and accurate finish has been developed by the Consolidated Machine Tool Corporation, Rochester, N. Y. This machine is built in vertical and horizontal types.

The Mill-N-Shaver can be arranged with one or more unit milling heads and the same number of shaving heads, or less, depending upon the requirements. Heads can also be placed at an angle to suit the surfaces to be finished. The shaving head is a heavy tool-block, on which one or more tungsten-carbide blades are mounted. This head is assembled on a ram provided with a micrometer adjustment for setting the depth of cut.

At the beginning of an operation the table is in the position opposite to that shown. After the work is loaded and clamped in the fixture and the cycle is started manually, the shaving head is automatically drawn back to clear the work. The table then advances at the rapid traverse rate and drops into a feed rate as the work reaches the rough milling cutter. At the end of the rough milling cut, the shaving head advances into the cutting position and the table returns at the rapid traverse rate to the loading position. It is during this rapid return that the work is shaved, thus eliminating the time that would otherwise be required for a finish cut by means of a milling cutter.

The principle of combined milling and shaving can be applied to various types of Newton milling machines, including the vertical continuous millers.

Sidney Lathes with 14- to 36-Inch Swing

A line of lathes built in sizes of from 14 to 36 inches swing and with either eight-, twelve- or sixteen-speed headstocks is now being built by the Sidney Machine Tool Co., Sidney, Ohio. Fig. 1 shows the 18-inch size with 72 inches between centers.

These new lathes are completely equipped with anti-friction bearings in the headstock, end gearing, gear-box, apron, lead-screw, and feed-rod. Ball thrust bearings are provided on all adjusting screws. They have automatic lubrication for the headstock, apron, and carriage mechanism, and a centralized reservoir for lubricating the gear-box.

Fig. 2 shows the headstock with cover removed to expose the herringbone gear transmission. The headstock is provided with internal and external gear tooth clutches. The claims made for this type of transmission are: (1) Through the use of herringbone gears there is better tooth contact, resulting in greater strength and smoother action; (2) by having all the herringbone gears constantly in mesh, there is a mini-

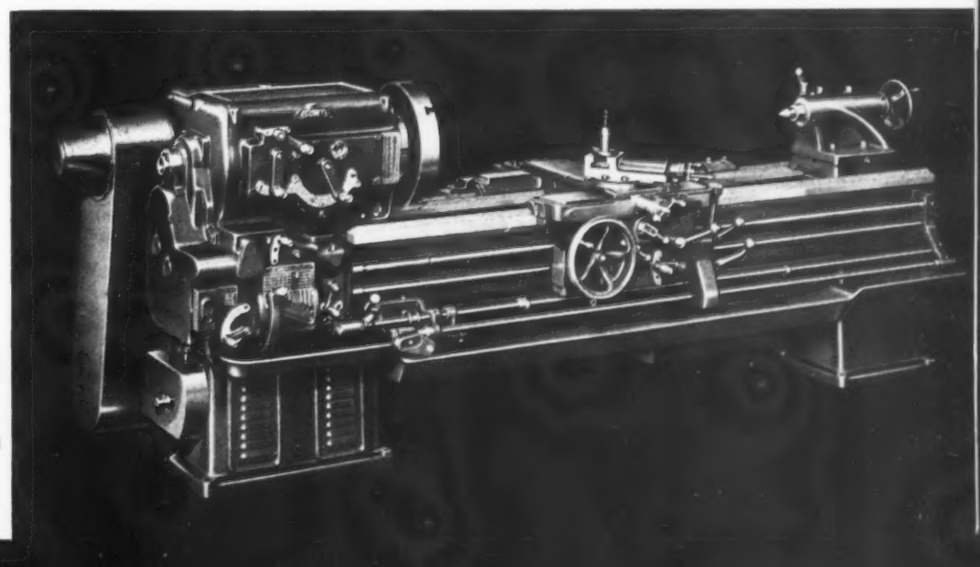


Fig. 1. Sidney 18-inch Lathe 72 Inches between Centers

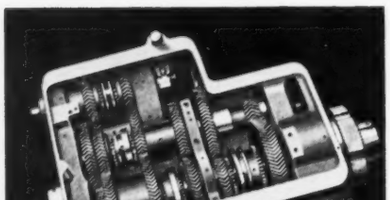


Fig. 2. Interior of Sidney Lathe Headstock

mum of backlash, assuring chatter-free operation; (3) the herringbone gears constantly in mesh, supplemented by the internal and external gear tooth clutches, hold the measurable amount of backlash to a minimum, which is especially advantageous when doing intermittent work; and (4) the center bearing on both the spindle and intermediate shaft adds greatly to the rigidity of the headstock, eliminating vibration when high speeds and feeds are used. This also places the bearings at 8-inch intervals.

This new line of lathes is also provided with a new type of bed having four longitudinal walls with cross-girts spaced at 12-inch intervals. This construction insures rigidity and permanent alignment, as the design resists any possible bending or twisting strains.

Leland-Gifford Drilling Machines

The Leland Gifford Co., Worcester, Mass., has developed a rail type drilling machine (Fig. 1) in which the spindles have both angular and longitudinal adjustment. In this machine, the company's hydraulic-feed drilling units are mounted on saddles and are driven by single-speed motors through V-belts. Either step-by-step feed for the drilling of long holes, such as oil-holes in crankshafts, or the regular type of hydraulic feed is available. The spindles can be tilted up to 45 degrees on either side, and the centers can be adjusted from 15 1/2 to 73 inches when in a vertical position. Interchangeable locating bars are furnished for quickly locating the heads on the rail. The machine can be furnished with one head only, or with hand feed to the spindle instead of hydraulic feed.

Another machine recently brought out by the company is the multiple adjustable-spindle drilling machine shown in Fig. 2. Among the features of this machine is a hand-controlled hydraulic feed which requires only finger-tip pressure on the feed-lever. There is no motion of the table the instant the feed-lever motion is stopped. In addition to this hand-controlled hydraulic feed, which can be entirely disconnected, a conventional type of hydraulic feed is available. This may consist of a single cycle of rapid approach, drilling feed, and rapid return, or may become an automatic cycle by the operator keeping his foot on a foot-treadle.

The rates of feed for drilling are from 1/2 inch to 150 inches per minute, with a fast approach of 240 inches per minute. The machine is driven direct by a four-speed motor, which, in conjunction with the two-speed gear ratio to the spindle, provides eight spindle speeds ranging from 830 to 4500 R.P.M. It is built in three sizes—having twelve, sixteen, and twenty-four spindles—and can be furnished with spindles of 3/8, 1/2, and 5/8 inch diameter.

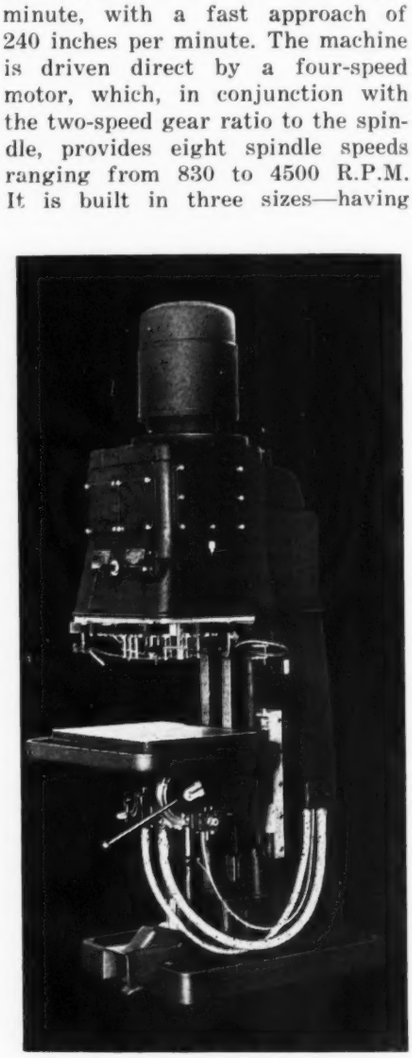


Fig. 2. Leland-Gifford Multiple Adjustable-spindle Drilling Machine

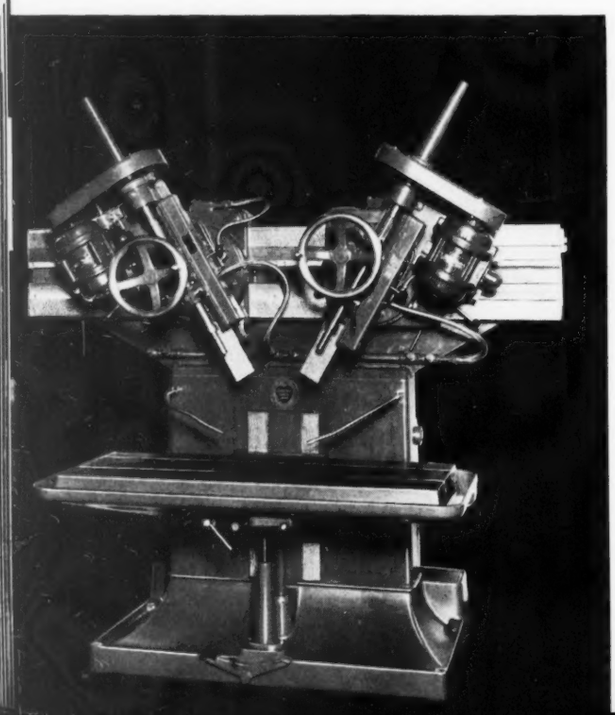


Fig. 1. Leland-Gifford Universal Rail Type Drilling Machine

Buffalo Forge Announces Several Machines

A new motor-spindle drilling machine built in two sizes—Nos. 2 and 3—has been brought out by the Buffalo Forge Co., Buffalo, N. Y., as shown in Fig. 1. The No. 2 size is available with 8, 12, and 15 inches overhang, and in bench and pedestal models. It is provided with a 2-H.P. motor obtainable in three different speed ranges. The No. 3 machine is available with 12 inches overhang and in the pedestal model only; it is provided with a 2- or 3-H.P. motor and one "medium-low" speed range. These machines are built in units of from one to six spindles.

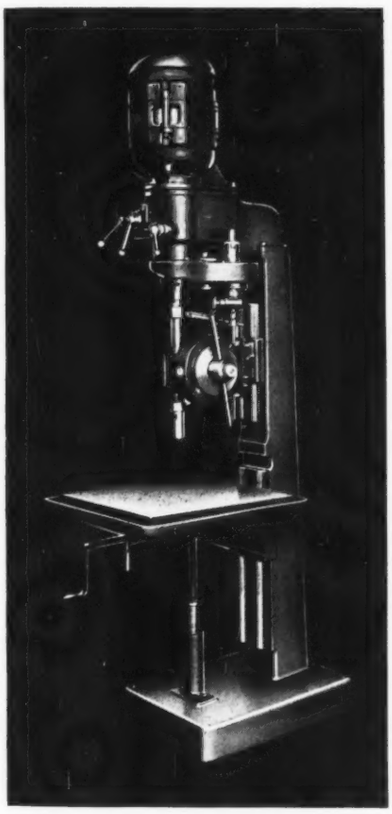


Fig. 1. Motor-Spindle Drilling Machine Brought out by the Buffalo Forge Co.

Another new machine is the No. 2 1/2 Universal Iron Worker shown in Fig. 2. This machine, while having several new features, follows the general principles of design of similar machines formerly built by the company and demonstrates the advantages of having five separate tools represented in one unit. The frame is of heavy armor plate construction, welded into one solid unit.

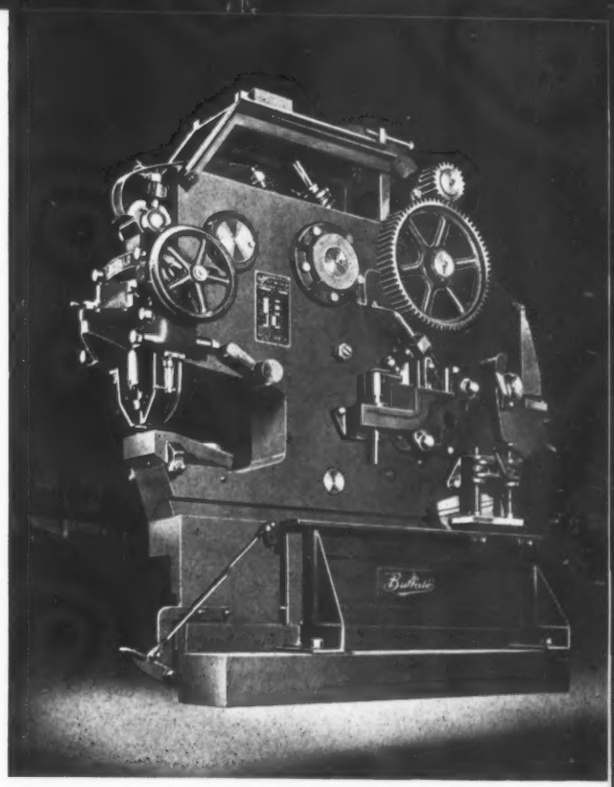


Fig. 2. No. 2 1/2 Universal Iron Worker Built by the Buffalo Forge Co.

Fig. 3 shows a new No. 00 bending roll especially intended for bending small angles and shapes for the aircraft industry and for similar work in other manufacturing fields.

Another recent development is the No. 2 Vari-Drive drilling machine. This machine is provided with variable-speed V-belt drive, giving an infinite number of speeds within its range. It is available with or without back-gears, with or without power feed, and with or without motor reverse tapping attachment; it is built in the same models as the No. 2 motor-spindle machine.

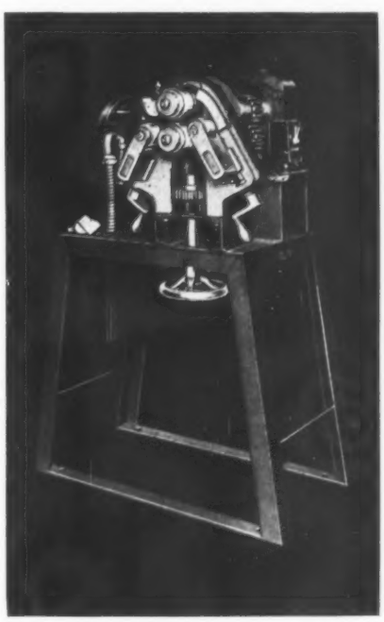
GE Definite-Mechanical-Time Starters

The General Electric Co., Schenectady, N. Y., has developed a new direct-current definite-mechanical-time starter for general-purpose constant-speed motors where jogging is not required. The rating is up to 5 H.P., 115 volts; and 10 H.P., 230 volts.

The new starter consists of a solenoid-operated multi-finger contactor with an overload relay. It is unique in that it employs a new time-delay escapement mechanism. In constant engagement with the operating shaft, this mechanism restrains the shaft in the starting motor, but permits quick opening through a positive over-running clutch.

These starters can be applied to constant-speed motors up to 1800 R.P.M. that do not require more than 150 per cent of full-load torque to start, nor longer than ten seconds to attain full speed. With proper accessories, starters provide overload and under-voltage protection.

Fig. 3. Bending Roll for Small Angles and Shapes



JAMES R. MUNRO

James R. Munro, factory manager of the Tractor Division of the Caterpillar Tractor Co., Peoria, Ill., was born at San Leandro, Calif. He served an apprenticeship with the C. L. Best Tractor Co. Upon graduating from this course in 1922, he worked as a toolmaker; in 1925, he became tool-room foreman, and in 1928, was placed in charge of the metallurgical and heat-treatment departments. When the Best and the Holt companies were merged into the Caterpillar Tractor Co., he went in 1931, to the company's Peoria, Ill., factory. There he became general supervisor of the new Diesel engine division, and later acted as assistant superintendent and superintendent. In 1936 Mr. Munro, then only thirty-two years old, was promoted to factory manager of the company's tractor division.

Machine Tools

By JAMES R. MUNRO
Factory Manager
Caterpillar Tractor Co.
Peoria, Ill.

THE demand for precision-built equipment has never been so great as it is today. Any manufacturing company that tries to maintain a leading position must constantly make its own manufacturing requirements more rigid. This refinement in product design has, as a matter of course, been passed along to the machine tool manufacturer. He must build a precision product, too, for the industries that he serves.

INCLUDED in the requirements of present-day machine tools are safety and comfort for the operator; a minimum of physical effort in operating; simplicity, compactness, and flexibility, and standardization of all parts, as far as possible.

CONSIDERATION of the operator should come first. He should be provided with a safe machine; he should be free from the in-

convenience and danger caused, for example, by splashing coolant or flying metal. Machine tool builders have done much in supplying effective guards to protect the workmen and are continuing to keep the operator's safety and comfort in mind. Likewise, machine tool builders are making progress in designing machines requiring a minimum of physical manipulation. Their efforts along these lines are to be commended. The machine tool builder also deserves praise for his successful efforts toward compact design. Owing to the increasing value of floor space in growing manufacturing plants, this feature is important.

THE time the operator spends in planning set-ups shortens the productive hours of any machine tool; therefore, simplicity is highly important, and, along with simplicity, there should also be flexibility. At a plant like that of the Caterpillar Tractor Co., the need for more single-purpose machines has grown; but, on the other hand, the demand for equipment that lends itself to varied uses has not diminished.

THE cost of maintenance would be reduced a great deal if there were more standardization of simple machine parts, such as bearings, oil seals, and especially parts that are subject to wear. Ease, speed, and economy of repairs are important considerations. The standardization of machine spindle noses and tapers has been paying the machine tool user big dividends. Further progress along these lines is to be recommended.

LUBRICATION should be given even more consideration in the future than at present. It is not unusual to find oil lines so placed that they become damaged during the normal usage of the equipment. Bearings are not always properly sealed, so as to keep in the lubrication and keep out the coolant. Not only does leaking lubricating oil present an unsightly appearance, but it is also the cause of many machine failures. Better bearing lubrication is still a problem that needs consideration.

A SIMPLE feature needing correction on many machines is the coolant sump. Frequently the coolant sump is a part of the machine provided with numerous supporting ribs, making it impossible to clean it properly; contamination of the coolant is the result.

TWO suggestions may be appropriate at this time with regard to the business relations of the customer and the machine tool builder. It would help the customer if the machine tool builder gave more thorough consideration to the customer's manufacturing problems and factory conditions in stating production figures in quotations for machine equipment. Often, in his zeal to submit an attractive proposal, he submits production figures based upon arbitrarily selected speeds and feeds rather than on the customer's actual operating conditions, materials, lot sizes, and cutting tools; hence, the estimates may be misleading. The second suggestion relates to delivery dates. The failure to keep delivery dates is a difficulty that the machine tool user faces on many occasions. Because of such delays, production plans are often upset and a manufacturer's entire sales plans may be affected. Cooperation between the machine tool builder and user in eliminating these difficulties will greatly benefit both sides in the transaction.

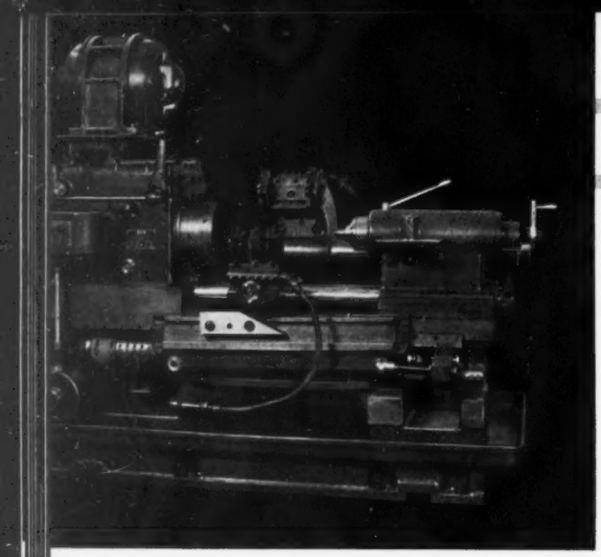


Fig. 1. (Left) Heavy-duty Fay Automatic Lathe Designed to Take Advantage of Modern Cutting Tools

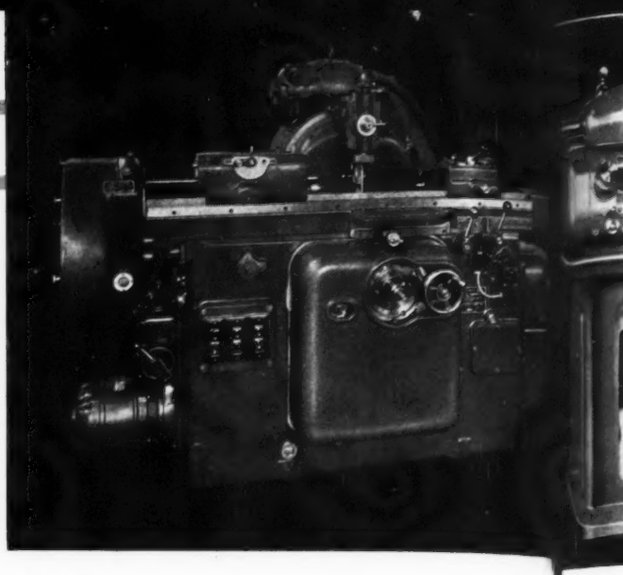


Fig. 2. (Right) Latest Model of Jones & Lamson Automatic Thread-grinding Machine

Machines Recently Added to the Jones & Lamson Lines

A heavy-duty 16-inch Fay automatic lathe designed to take full advantage of modern hard-alloy cutting tools has been developed by the Jones & Lamson Machine Co., Springfield, Vt. This machine, which is shown in Fig. 1, is constructed to transmit in excess of 50 H.P. It is furnished in five standard lengths with a capacity between centers of 23, 35, 53, 71, and 89 inches. Work up to 12 1/2 inches in diameter can be swung over the carriage, and 17 1/2 inches in diameter over the center bar and back bar. Eight spindle speeds from 28 to 180 R.P.M. are available with a standard set of change-gears. The machine is equipped with an extra large and low chip pan. In an operation on one of these machines in which carbide-tipped tools rough-turn and face a cluster gear, the actual cutting time is only fifteen seconds.

Round bars and tubing up to 5 inches in diameter can be machined in the No. 7A-5 universal turret lathe illustrated in Fig. 3 by extending the work through the spindle. The swing over the way covers of this machine is 19 inches, and over the carriage cross-slide 13 inches. The scroll chuck has a capacity of 12 inches. The headstock is fitted with a Type B1 American standard lathe spindle nose 11 inches in diameter. The No. 5 ram type machine can be furnished with 2 1/2-inch capacity bar turret tools, and the No. 8A saddle type machine with 3-inch capacity bar turret tools.

The cross-slide of both ram and saddle type turret lathes can now be furnished with power rapid traverse. In a typical operation performed on a machine with this equipment, in which fast cutting tools are used to machine a bronze pump impeller, even long facing cuts are taken within six seconds. The power rapid traverse of the cross-slide reduces fatigue of the operator to a minimum and creates a closer relation between the handling time and the actual cutting time of operations.

An automatic thread-grinding machine having a capacity for grinding threads up to 6 1/2 inches maximum diameter with a 20-inch wheel is shown in Fig. 2. This machine will swing work 7 1/2 inches in diameter, will take work up to 36 inches long between centers, and will grind threads 12 inches long in one setting.

Three types of automatic truing devices are available. Other features include a rheostat control of the grinding wheel speeds; automatic compensation for the amount of material dressed off the wheel; automatic in-feed of the wheel on successive cuts; automatic sizing; an attachment for grinding relief on taps, hobs, etc.; and a hob-grinding attachment for annular grooves.

Hendey Tool- and Gage-Makers' Lathe

A high-speed sensitive precision lathe built to meet the demands for a lathe that is heavier and has greater adaptability than the regular bench lathe has been brought out by the Hendey Machine Co., Torrington, Conn. This machine has a range of spindle speeds of from 40 to 2000 R.P.M. Any speed in this range is obtainable. The speeds from 500 to 2000 R.P.M. are obtained through multiple V-belt drive directly to the spindle, without the use of gears. The range from 40 to 500 R.P.M. is obtained through back-gears of low pitch-line velocity.

The lathe has two ranges of feeds, one through a belt from the spindle, and the other through the gearing used for thread cutting. The quick-change gear-box gives sixty-six changes of threads and a like number of feeds for either belt or gear drive. On the index-plate, the sixty-six threads range from 2 to 120 per inch without duplication. Both the thread and feed ranges are incorporated in the quick-change gear feature without any gear change being required. The pick-off gear sector

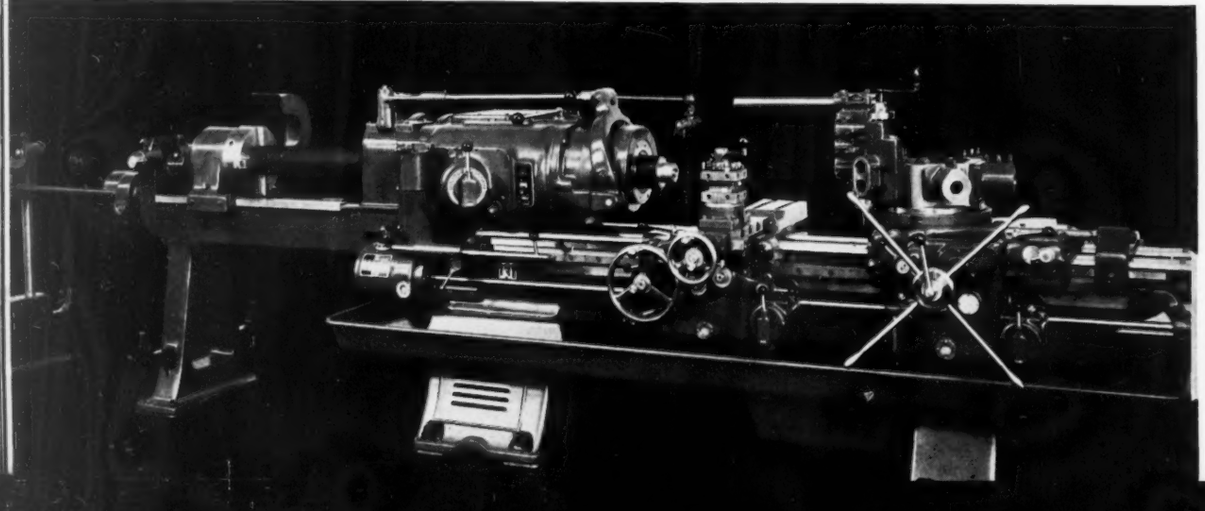
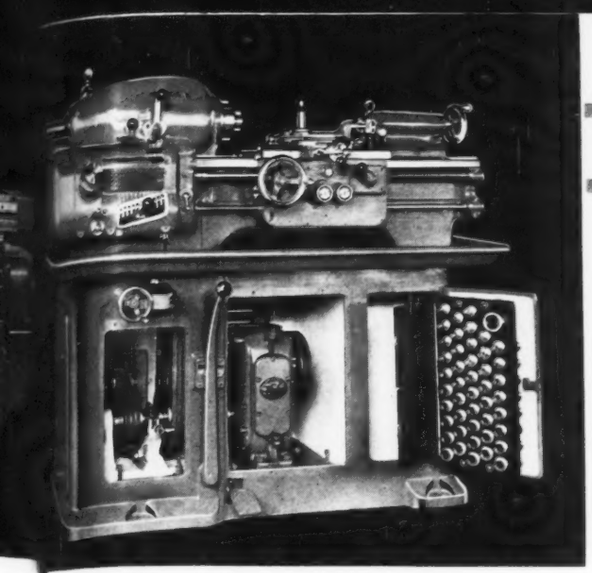


Fig. 3. J&L Saddle Type Universal Turret Lathe with Large Spindle Bore



(Left) Hendey Tool- and Gage-Makers' High-speed Precision Lathe

(Right) Latest Style of Rotary Surface Grinder Built by the Arter Grinding Machine Co.

permits of combinations in change-gears to any reasonable degree. It is possible to cut any prime number thread up to 131.

The principal dimensions are as follows: Swing over ways, 10 1/4 inches; hole through spindle, 1 1/2 inches; maximum capacity of spring collets, 1 1/8 inches. The height of the centers above the floor is 45 3/4 inches. The approximate weight of the lathe, complete with power unit, is 2480 pounds.

Sebastian Type S Geared-Head Lathes

A new box type headstock is one of the features recently incorporated in the Type S geared-head lathes built by the Sebastian Lathe Co., Cincinnati, Ohio. These machines, which are regularly built in 12-, 16-, and 20-inch sizes, are now of the appearance illustrated. Other new features that have been added since the lathes were described in November, 1938, MACHINERY, include an oil reservoir in the apron, a 1 3/8-inch hole through the spindle, a 1-inch collet capacity, and a drop-lever for controlling the friction feed in the apron.

The Type L cone-head lathes, built by the concern in swings of 10, 12, and 13 inches, have also been improved since their description in March, 1938, MACHINERY. These lathes, too, are now being supplied with a drop-lever for controlling the friction feed in the apron, and with an oil reservoir in the apron. They also have a 1 3/8-inch hole in the spindle and a collet capacity of 1 inch.

Arter Model D Rotary Surface Grinder

Many improvements in construction are incorporated in a Model D rotary surface grinder recently added to the line of the Arter Grinding Machine Co., Worcester, Mass., which concern builds machines of this type in sizes ranging from 8 to 40 inches in diametral capacity. The wheel-head of the new machine is hydraulically operated to give smoothness to the traverse, as well as an infinite range of speeds. The wheel-spindle is vertical centrally with the ways of the wheel-slide, thus offering maximum stability to the spindle mounting.

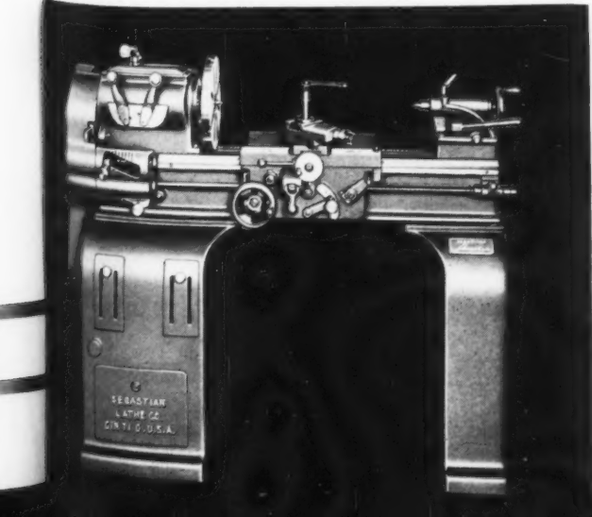
The drive to the wheel-spindle is through short multiple V-belts from a motor on the wheel-slide. Thus maximum power is delivered to the wheel, and belt adjustments and replacements are easily made. This construction also permits the use of a short sturdy spindle mounted in an adjustable bearing at the front end, and in a double-row ball bearing at the rear. The front bearing is lubricated continuously from a reservoir in the wheel-head, while the wheel-slide ways are automatically lubricated from a pressure pump.

The chuck-spindle is mounted top and bottom in preloaded double-row ball bearings. It is driven by worm-gearing and a V-belt from a variable-speed motor. Hand elevation is effected through a handwheel and automatic elevation by hydraulic means at either or both ends of the stroke.

Oster "Tom Thumb" Portable Pipe Machine

One of the new developments of the Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio, is a No. 562 "Tom Thumb" pipe machine having a capacity for pipe from 1/2 inch to 2 inches, inclusive, through the spindle. It is also capable of driving geared die-stocks up to 8 inches capacity through a universal shaft. The machine has a welded steel base and guards, giving it maximum strength with minimum weight.

A new type die-head integral with the carriage provides rigid support for the threading dies. The die-head is of the front-cutting type, which, in conjunction with the "close grip" front chuck, permits lengths of pipe as short as 2 1/2 inches to be



(Left) Sebastian Geared-Head Lathe with New Box Type Headstock

(Right) Oster "Tom Thumb" Portable Pipe Machine with a Capacity of from 1/2 to 2 Inches

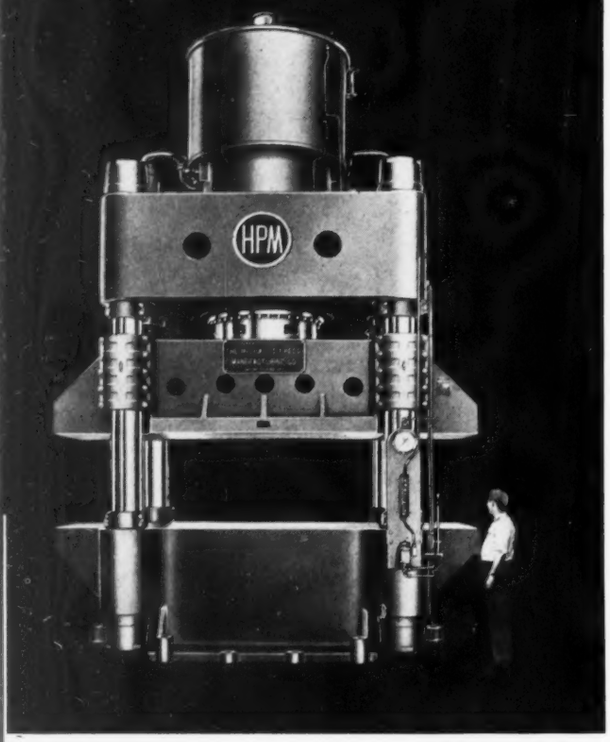


Fig. 1. H-P-M Fastraverse Press Adapted for Forming Complicated Parts by Guerin Process

threaded without the use of a nipple chuck.

The machine is equipped with a built-in lathe type cut-off attachment, operated by a ball-crank handle and opposed by a V-block steadyrest to take the thrust of the tool. A combination reaming and chamfering tool mounted on the cut-off block performs both of these operations simultaneously. The weight of the machine is 450 pounds.

H-P-M Fastraverse and Injection Molding Presses

A self-contained hydraulic press designed primarily for the fabrication of duralumin airplane parts has been built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This machine has a pressure capacity of 2000 tons, and pressing surfaces 92 by 72 inches at the sides and 60 by 180 inches at the ends. It is especially suited for forming or blanking many different parts in one operation by the Guerin process, which consists fundamentally of using a block of rubber for the press platen instead of the customary metal die. From two to thirty-five complicated parts can be formed in one operation or as many as sixty-five blanks can be cut in one stroke. At least a thousand different parts are being handled by this method, some of which require a 4-inch draw.

The single press action of the main platen is accomplished by the hydro-power closed circuit operating system. Power is furnished by a 100-H.P. electric motor connected by flexible couplings to a hydro-power radial pump. Directly connected to the radial pump by seamless steel high-pressure tubing are three cylinders—the main cylinder and two auxiliary pull-back cylinders. There are no operating valves between the pump and cylinders, the ram being returned by reversing the pump instead of controlling the oil flow by operating valves. The working pressure can be adjusted to suit requirements. A fast closing and opening speed are available. Ram travel control is either manual or automatic, as desired.

Fig. 2. Hydraulic Drawing and Tapering Press for Artillery Shells

The same concern has also developed the shell drawing and tapering

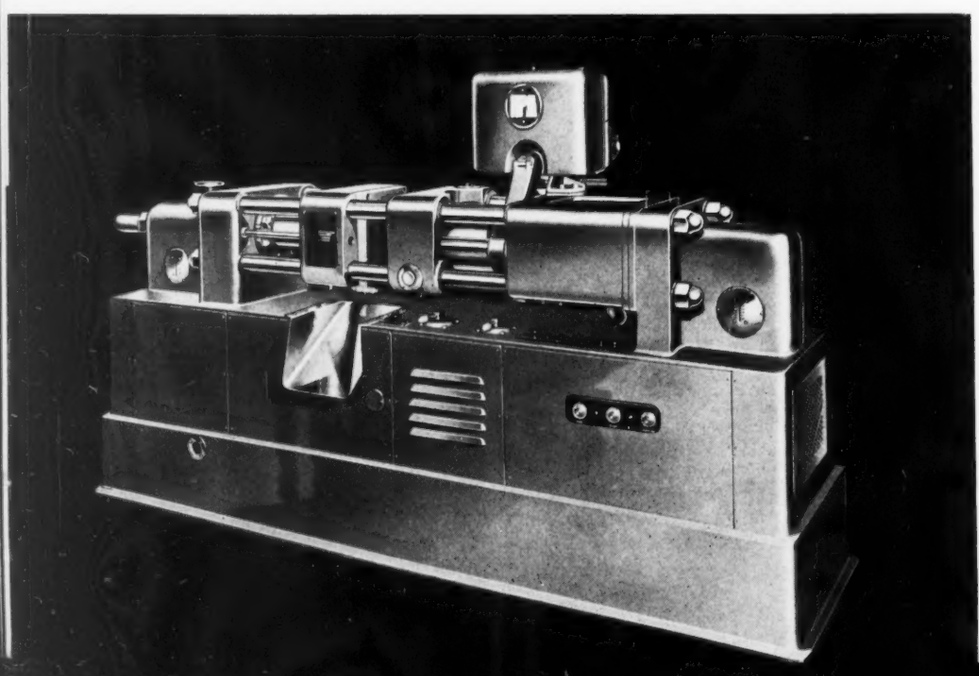


Fig. 3. Latest Type of H-P-M Injection Molding Press

press shown in Fig. 2 to meet the requirements of artillery-shell manufacture. Hydraulic pressure for the operation of this press is also generated by a hydro-power radial variable-delivery pump, and there are no operating valves between the pump and the main pressure cylinder. As in the case of the machine described in the foregoing, the travel of the ram is reversed by simply reversing the hydro-power pump, this arrangement permitting the press to operate without shocks.

With the power unit mounted on a bracket fastened to the head of the press, there is no obstructive piping or power unit equipment around the base so that a minimum of floor space is necessary for the installation. Presses intended for shell tapering are equipped with a mechanical ejector beneath the press bed. Drawing presses are designed with a hole in the center of the bed through which a drawn shell is pushed and stripped from the punch. The pressing surfaces of the equipment shown are 30 by 30 inches, and the maximum ram travel is 120 inches.

Another recent machine developed by the same company, is the Model 40-H-2 injection molding press illustrated in Fig. 3. This equipment consists of two separate units consolidated into one machine, that is, an injection unit and a clamp unit, each of which is provided with its own operating valves and controls.

The injection unit comprises a nozzle with a material chamber, automatic feed, and hopper. Means of plasticizing the material are incorporated in this unit. The clamp unit consists of a cylinder and ram to which the traveling platen is fastened, four tie-rods, and a floating abutment which is controlled by two cushion cylinders. Provision is made to advance the clamp platen to the closed position at which time the full clamping pressure is developed.

Twelve-inch Hy-Draulic Vertical Shaper Developed by the Rockford Machine Tool Co.

Rockford 12-Inch Vertical Shaper

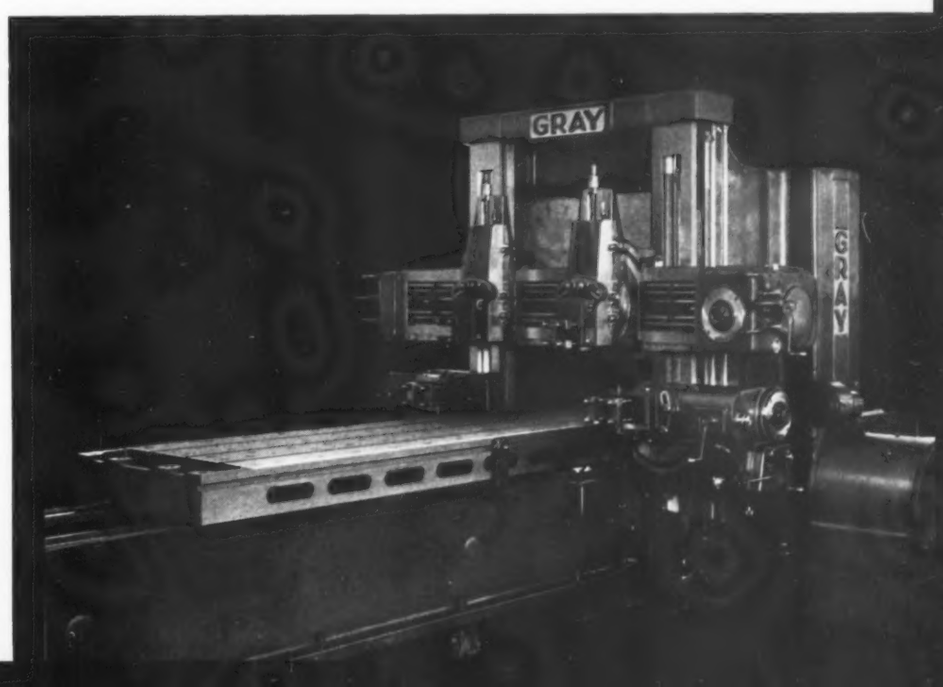
A 12-inch Hy-Draulic vertical shaper has been developed by the Rockford Machine Tool Co., Rockford, Ill., largely from the experience gained in building the 20-inch machine of this type. While smaller in all proportions and intended to perform vertical shaping work rather than the heavier operations of slotting, the new shaper is designed along the same lines as the larger machine. With power and rigidity it combines speed and accuracy.

The hydraulic drive of the ram is designed for a maximum of 150 strokes per minute, with a minimum stroke of 1 inch. The table is provided with micrometer adjustments for both the longitudinal and lateral travel. Dial indicators and precision measuring bars are provided for accurate setting, the same as in jig boring machines.

The maximum ram speed is 150 feet per minute, and the minimum 10 feet per minute. The transverse power feeds of the table vary from 0 to 0.100 inch, and the longitudinal power feeds from 0 to 0.065 inch. The net weight of the machine, without the electrical equipment, is 10,000 pounds. The machine is provided with a main drive motor, 7 1/2 H.P., 1200 R.P.M.; a rapid-traverse motor, 1 1/2 H.P., 1200 R.P.M.; and a pendent push-button station for the complete control of all operations.

Gray "Maximum Service" Planer

The Maximum Service planer here shown which has been brought out by the G. A. Gray Co., 3611 Woodburn Ave., Cincinnati, Ohio, differs in many respects from previous machines of this type. Owing to improvements in control and drive, the time formerly required for actual planing is said frequently to be cut



Gray "Maximum Service" Planer Embodying Many New Features

Fig. 1. Maag Helical and Spur Gear Grinding Machine Introduced by the Triplex Machine Tool Corp.

in half, and, in some cases, even greater savings have been possible.

The control levers for feed and rapid traverse are located at both ends of the rail, as well as at the heads themselves. With the exception of the motors, all rail elevating and rapid traverse parts on the top brace are fully enclosed, and the power traverse and elevating gears run in a bath of oil.

The housings have been made deeper and also widened at the rear to form a well that completely encloses the over-size counterweight. This construction not only eliminates the counterweight braces, cables and weights, but also greatly stiffens the housings in both directions.

The patented all-helical gear train, with its absence of backlash, makes it feasible to utilize to the fullest extent the rapidity of reversal of the newly developed variable-voltage drives. A drive of this type, in conjunction with a 5-to-1 all-helical gear train, permits both cutting and return speeds ranging from 8 to 240 feet per minute.

Triplex Announces New Jig Boring, Gear Grinding and Centerless Grinding Machines

A new Swiss jig boring machine is being placed on the market by the Triplex Machine Tool Corporation, 123 Barclay St., New York City. This jig boring machine, known as MP-4G, has a measuring range of 24 by 20 inches and a boring range of 9 inches diameter. The two distinctive features claimed for this machine over previous designs are higher working speeds and reduction of idle time. Twenty spindle speeds ranging from 50 to 2000 R.P.M. are provided, with six power feeds from 0.001 to 0.012 inch per revolution of the spindle. These speed and feed ranges make the machine suitable for the use of tungsten-carbide tools. The work-table and spindle-head settings are read directly to 0.00005 inch.

The Maag type HSS-30 helical and spur gear tooth grinding machine, shown in Fig. 1, is also sold by the same concern. It has a capacity for gears of from 1 3/8 to 11 3/4 inches in diameter, and from 25 to 2 1/2 diametral pitch. It will handle gears with face widths up to 6 3/8 inches and with a helix angle up to 45 degrees. The machine has been developed especially for production grinding of precision gears to close limits of accuracy.

Malcus centerless grinding machines have also been added to the Triplex line. The grinding and regulating wheels of these machines are provided with bearings on both sides,

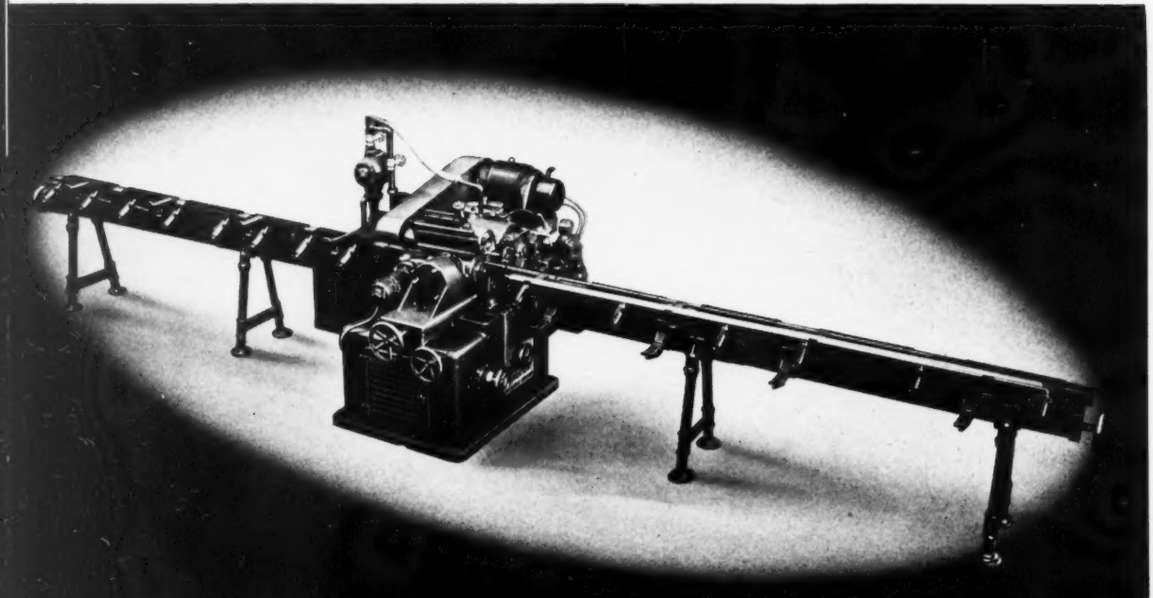


Fig. 2. Malcus Centerless Grinding Machine Available with Various Feed Tables

and both of these wheels are adjustable on long slides against the work support. The grinding spindle has a long plain bearing which is lubricated by a patented method so as to practically eliminate wear.

The direct electric drive and regulating of the feed-wheel insure efficient control of the grinding. Feed adjustments can be made during an operation. Automatic dressing of the grinding and regulating wheels is controlled from profile guides. Auxiliary equipment, such as automatic feed mechanisms, motor-driven feed tables, and a tapered grinding device, can be supplied.

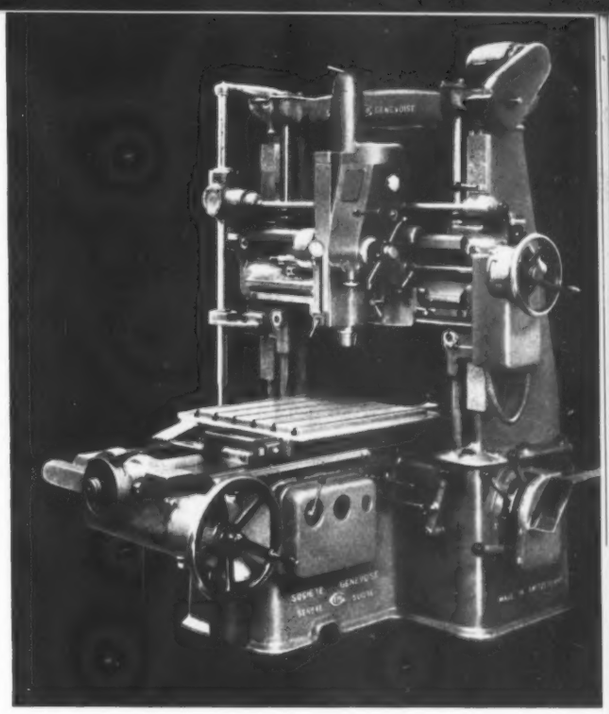


Fig. 3. Swiss Jig Boring Machine Placed on the Market by the Triplex Machine Tool Corporation

Goss & DeLeeuw Two-Spindle Automatic Chucking Machine

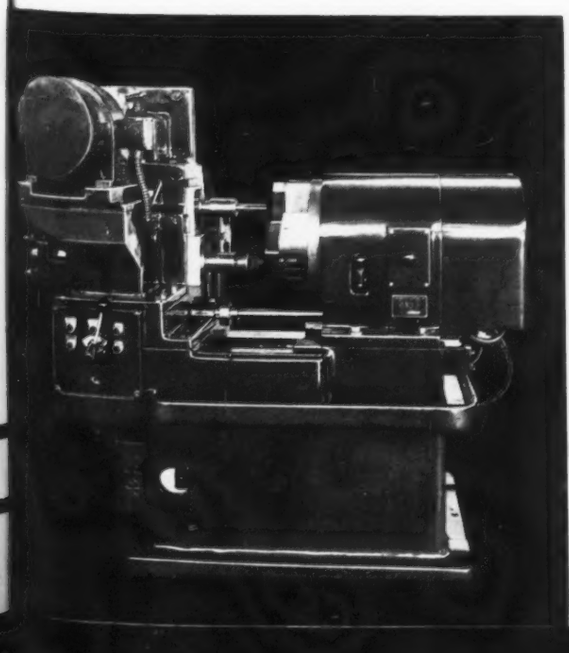
The chucking machine shown in the illustration has been developed by the Goss & DeLeeuw Machine Co., New Britain, Conn., to meet the need for a simple, versatile, quickly set-up automatic suitable for the large number of comparatively simple chucking jobs frequently machined by more expensive methods.

The machine has two horizontal spindles that revolve the cutting tools. Opposite them on a faceplate are three work-holding chucks, two of them presenting the work to the tools and the third being in a position for loading. The indexing faceplate carries the work successively from the loading position to the first spindle, then to the second spindle, and then back to the loading position; thus two machining operations are being performed while the loading is taking place. The finished piece is automatically ejected from the chuck between the second and the loading positions. The operator has only to place a new piece in the open chuck and trip the closing valve. The mechanisms for indexing, feeding, and withdrawing the tools, and for starting, reversing, and stopping the threading spindle are automatic, and are mechanically interlocked.

The spindle speeds range from 100 to 1000 R.P.M. for threading, and up to 3500 R.P.M. for machining cuts. The threading spindle drive can handle small tapping jobs up to thirty pieces a minute, and yet has ample power for a 1 1/4-inch taper pipe tap in brass or iron. All threading tools are controlled by positive lead-screws in constant engagement with their lead-nuts. The machine can be arranged to cut two threads of different pitches and diameters simultaneously, using the same spindle, both threads being controlled by lead-screws.

Frew Duplex Hand Milling Machine

A hand-feed machine for milling both sides of a piece of work at the same time has been developed by the Frew Machine Co., 124 W. Venango St., Philadelphia, Pa. As shown in the illustration, the machine consists of two columns mounted on a heavy bed, one column being stationary and the other movable. The stationary column carries the knee, saddle, and table. The table is moved by means of the hand-lever and a gear meshing with a rack; the in-and-out movement of the table is by means of a screw having a squared end for a wrench. The vertical movement of the knee in the machine illustrated is effected by a hand-wheel; the machine can also be furnished with lever feed to the knee, the movement being actuated by a rack and pinion. The movable column is adjusted by means of the hand-wheel at the end of the bed. The column can be locked in any position.



(Left) New Two-spindle Automatic Chucking Machine Built by Goss & DeLeeuw

(Right) Duplex Hand Milling Machine Developed by the Frew Machine Co.

The spindles are carried in Timken roller bearings. In each column there is a 3/4-H.P. motor mounted on a pivoted plate. A V-belt cone on both motor and spindle gives three spindle speeds, the standard speeds being 600, 900, and 1200 R.P.M. Belt tension is provided by the weight of the motor. To shift the belt, the operator presses down on a hand-lever at the rear of the machine which raises the motor unit, thus slackening the belt so it can be dropped on the desired cone step.

New Machines Developed by Sundstrand Machine Tool Co.

A new machine has been developed by the Sundstrand Machine Tool Co., Rockford, Ill., known as the Hydro-Screw Rigidmil (Fig. 1), which has a combination screw and hydraulic drive to the table. It is the result of an effort to produce an absolutely positive drive which will still have the flexibility of the hydraulic drive. The machine has a table screw driven by a hydraulic transmission providing an infinite number of feeds ranging from 1/2 inch to 60 inches per minute, and a rapid traverse rate of 300 inches per minute. The machine can be used for either climb or conventional milling. The wide variety of table cycles include skip feed in both directions, reverse from feed to feed, and a different rate of feed in opposite directions in the same cycle. The spindle head on the standard machine has a 30-to-1 ratio drive, and is available in three different speed combinations. The heads have independent motor drive.

Another new machine brought out is the No. 1 Rigidmil designed for convenience and flexibility in production work. The feeds can be changed from the front of the machine by revolving a calibrated dial, which can be set accurately to any desired feed from 1/2 inch to 31 inches per minute. A wide range of table cycles is available, with accurate stops for plunge milling. The machine is adaptable to either climb or conventional milling. Separate motors are used for the feed drive and the spindle drive. The ratio of the spindle speed is 60 to 1.

Fig. 2. Sundstrand No. 1 Rigidmil Designed for Flexibility in Production Work

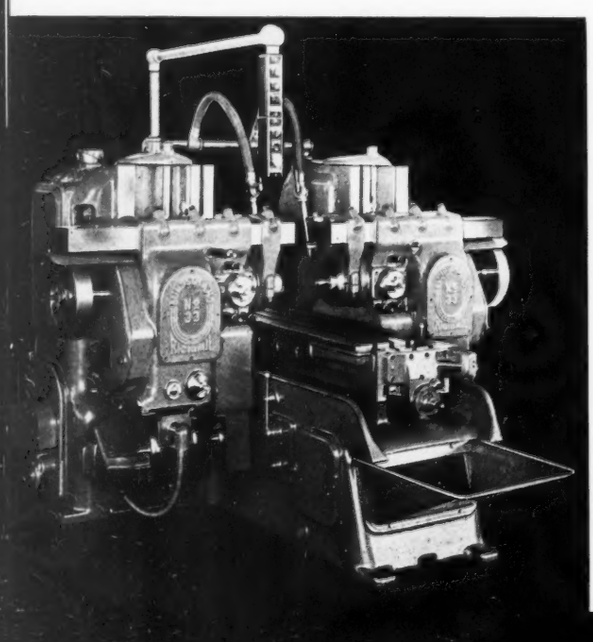


Fig. 1. Sundstrand Hydro-Screw Rigidmil of the Duplex Type

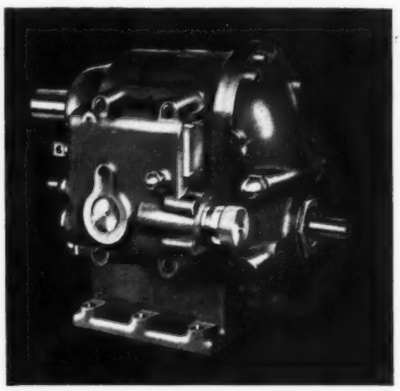


Fig. 3. Sundstrand Oil-power Variable-speed Transmission

The company also announces a new 2-H.P. oil-power variable-speed transmission (Fig. 3), especially designed for machine tool applications, but suitable for other industrial applications as well. It has a speed range, steplessly variable, from 10 to 3000 R.P.M. This equipment is small and compact, with a multiple-piston pump mounted below an oil-power fluid motor. No valves are used in reversing and no rotary valves are employed. Either mechanical, hydraulic, or electric controls can be provided.

Henry & Wright 25-Ton Dieing Machine and Stock Straightener

A new high-speed 25-ton dieing machine known as the "Speedmaster" has been brought out by the Henry & Wright Mfg. Co., Hartford, Conn., with the view of providing for an exceptionally high rate of production with progressive dies. The basic principles previously applied to the company's dieing machines have been incorporated in the new machine, and several features have been added to permit high-speed operation, including new counterbalancing, new precision feed drive, a variable-speed machine drive, and new bearing and lubricating provisions for high-speed operation. The machine is illustrated in Fig. 2.

The machine is capable of operating at 600 strokes per minute with

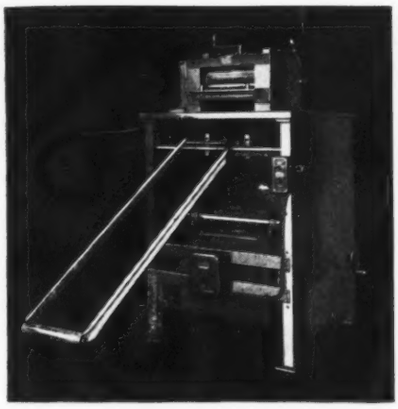


Fig. 1. Power-driven Stock Straightener Made by the Henry & Wright Mfg. Co.

progressive dies. It is not limited to blanking and piercing operations, but also performs drawing, forming, and extruding operations. A cam-actuated roll release is included in the feed mechanism.

The concern has also developed the automatically controlled power-driven straightener illustrated in Fig. 1, which has seven hardened and ground straightening rolls in addition to feed rolls. The straightener is motor-driven through a variable-speed transmission, so that it is possible to time the delivery rate of the straightener with the feeding rate of the dieing machine or press with which the straightener is being used. Further control is provided by means of a balanced arm which rests upon the material between the straightener and the press. This arm actuates a switch for starting or stopping the motor as the loop of material rises and falls, thus insuring free material at all times. The rolls are adjustable for height.

New Equipment of the Taft-Peirce Mfg. Co.

The surface grinder shown in Fig. 1 was originally designed and built by the Taft-Peirce Mfg. Co., Woonsocket, R. I., for use in the company's own small tool and gage divisions, where for more than a year it has given complete satisfaction for the grinding of tools, dies, gages, and other small parts. It is built with unusually sturdy proportions for its size.

Ball bearings are provided for all rotating shafts, and ball tracks of hardened alloy steel for the table, saddle, and spindle column travel. The wheel-spindle is so mounted that it swivels in a vertical plane about the center of the wheel, thus simplifying set-ups and adjustments.

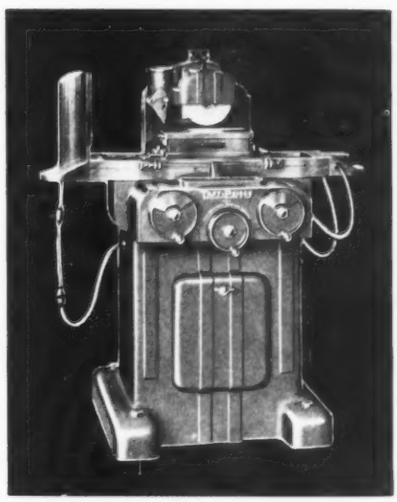


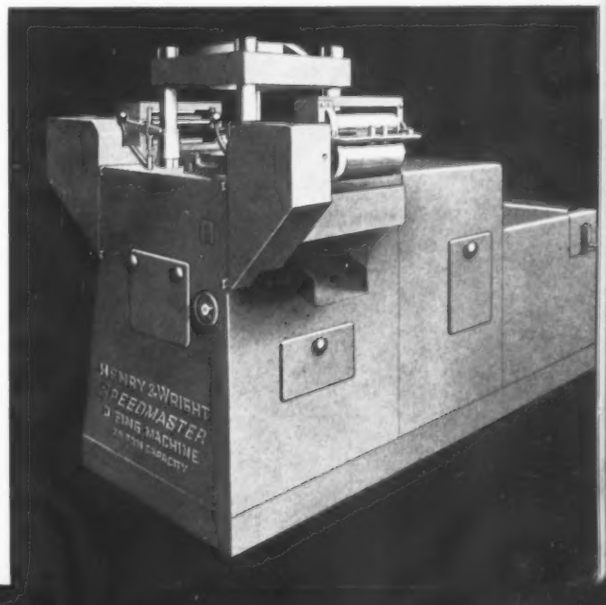
Fig. 1. Taft-Peirce Surface Grinder of Heavy Design in Proportion to Its Size

Fig. 2. Taft-Peirce Universal Angle-gages for Any Size Angle

An extensive line of gages, magnetic chucks, V-blocks, sine bars, dial indicators, reamers, and other precision tools and shop accessories has also been developed by the company. Among this new equipment is the demagnetizer for "Superpower" chucks, shown in Fig. 3, which has been designed to meet the demand for a demagnetizer of a larger capacity than the original alternating-current type. The present demagnetizer is a double unit, 13 1/4 inches long, 13 inches wide, and 6 1/2 inches high, weighing 60 pounds.

A new set of universal angle-gages to be applied directly to the work is shown in Fig. 2. With this set, it is possible to produce accurately any angle from 0 to 180 degrees by 5-minute increments. The set consists of ten independent angle-gages, seven of which are parallel blades with a pair of supplementary angles on each end, and three of which are triangles. The

Fig. 2. Henry & Wright "Speedmaster" Dieing Machine



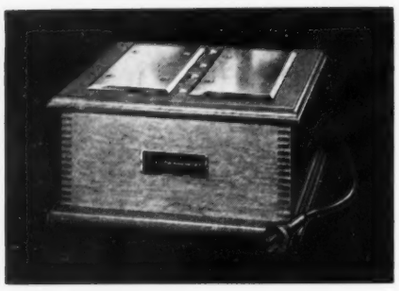


Fig. 3. Taft-Peirce Demagnetizer for "Superpower" Chucks

variation from the exact angle of any combination does not exceed one minute. The members are held in combination, when in use, by a clamping device, three being provided in each set.

Among other newly developed tools and devices may be mentioned cemented-carbide plug, thread, ring, and snap gages; magnetic parallels and V-blocks; and combination angle-block and sine-bar sets.

Ex-Cell-O Grinding Spindle and Hydraulic Power Unit

The Ex-Cell-O Corporation, Detroit, Mich., has developed a spindle for internal grinding machines which is driven by a built-in high-cycle motor. The principal advantage claimed for this spindle (Fig. 1) is the delivery of more power to the grinding wheel and the elimination of belt slippage and vibration.

A small hydraulic power unit (Fig. 2) that can be operated at spindle speeds from 370 to 1590 R.P.M. and is designed for handling drills from 3/16 inch up is also announced. When the unit is equipped with a multiple head or speeder unit, drills smaller than the minimum size mentioned can be used. Although the unit has a weight of only 220 pounds, it can be powered by motors up to 3 H.P. It is capable of drilling a 3/4-inch hole in steel and has a maximum stroke of 4 1/8 inches.

Motor Base Provided with Spring Tension

A new motor base which automatically maintains the correct belt tension through the action of special steel springs has been placed on the market by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. This motor base, designated as the "Automatic," is especially suited for short-center drives. One motor base covers all kinds of drives including horizontal, vertical, or overhead types.

To take up slack in belts resulting from normal wear and stretch, it is only necessary to give the adjusting screw of the base a few turns. The base is constructed of steel. The motor is mounted directly on the sliding plate, and the complete motor and base can be bolted down as a unit. Belts can be easily changed by simply releasing the spring tension.

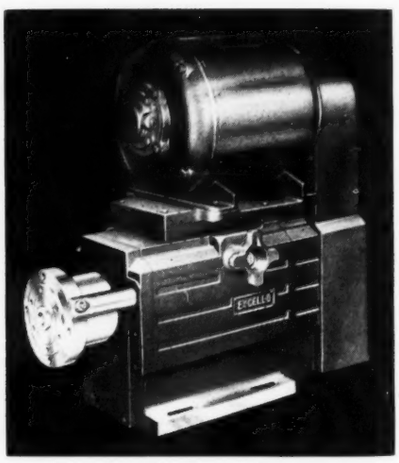
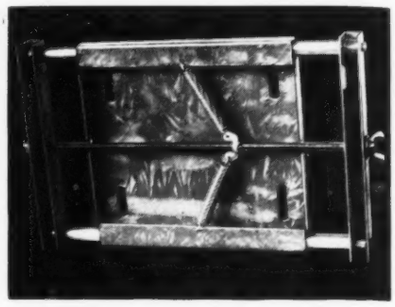


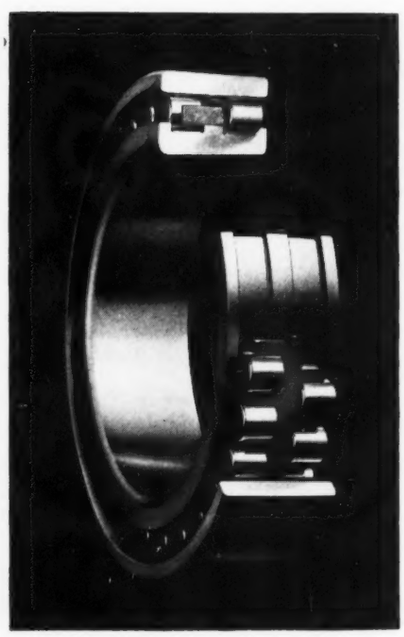
Fig. 2. New Hydraulic Power Unit Developed by the Ex-Cell-O Corporation



Adjustable Spring Tension Motor Base Made by Ideal Commutator Dresser Co.

S K F Double-Row Cylindrical Roller Bearing

An extra light double-row cylindrical roller bearing has been brought out by S K F Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa. Although the bearing is of very light section, it has high radial capacity, extreme rigidity, and smoothness of operation, due to the use of a larger number of staggered rollers.



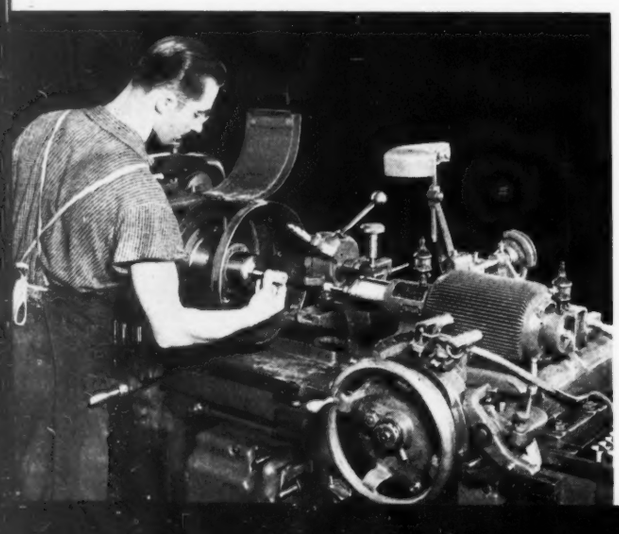


Fig. 1. (Left) Ex-Cell-O Internal Grinding Spindle with High-cycle Motor

(Right) S K F Extra Light Double-row Cylindrical Roller Bearing

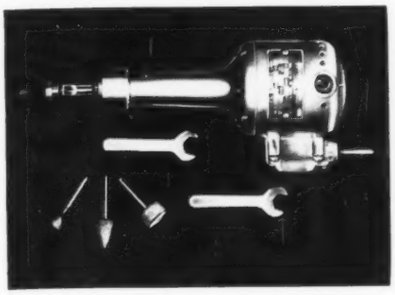


Fig. 1. Clark High-speed Grinder Designed for Die-sinking Work

Clark Portable Grinder and Utility Drills

A high-speed ball-bearing die grinder with the motor protected from overload by replaceable fuses which permit a momentary overload, and a utility ball-bearing drill made in 3/8- and 1/2-inch sizes are two recent developments of the J. S. Clark, Jr., Electric Co., 600 E. Bergman St., Louisville, Ky. The die grinder, shown in Fig. 1, is adapted for use in die shops, tool-rooms, and metal-working shops. It is capable of driving a 1- by 3/4-inch wheel at a no-load speed of 20,000 R.P.M., weighs 4 1/2 pounds, and is 10 7/8 inches long.

The improved utility ball-bearing drills brought out by this company are designed for high-speed production work. They have a special double reduction drive designed to reduce to a minimum the offset distance from the top of the motor housing to the center of the drill. The 3/8-inch drill has a no-load speed of 900 R.P.M., and weighs 8 1/2 pounds. The 1/2-inch drill, in Fig. 2, has a no-load speed of 650 R.P.M., and weighs 9 1/2 pounds.

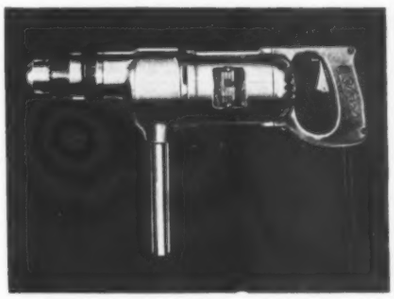


Fig. 2. Clark 1/2-inch Utility Ball-bearing Portable Drill

Hilco Oil Reclaimer

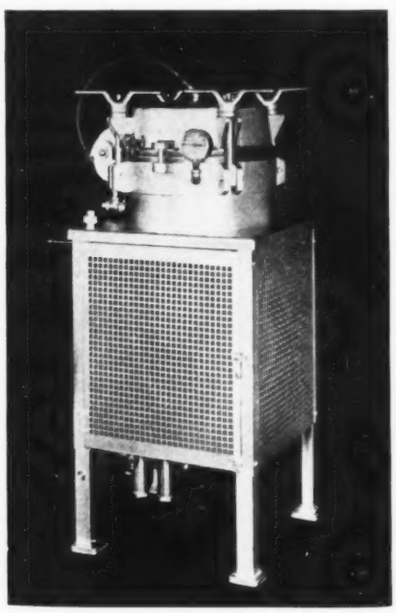
The Hilliard Corporation, 115 W. 4th St., Elmira, N. Y., has recently brought out a new Model B oil reclaimer designed to remove all solid matter such as sludge, carbon, abrasives, and dust from oil. It also restores the color of the oil and removes moisture and dilution by a process of evaporation under vacuum in an electrically heated vaporizing chamber. The capacity ranges from 6 to 50 gallons per day, depending upon the type of oil to be purified.

Stow Multi-speed Flexible-shaft Machine

Stow Junior Multi-Speed Flexible-Shaft Machines

A multi-speed flexible-shaft machine of the design illustrated, has been added to the Junior line of the Stow Mfg. Co., Inc., 15 Shear St., Binghamton, N. Y. This machine is intended for grinding, drilling, polishing, wire scratch-brushing, and other applications. It is mounted on a four-caster base and is equipped with an adjustable arm for regulating the belt tension. The shaft is designed on the same principle as the one used in the heavy-duty machines of the concern.

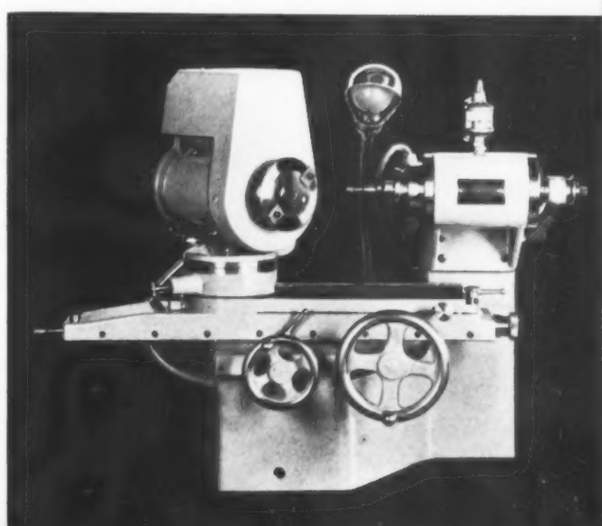
This model may be equipped with either a 1/4- or 1/3-H.P. motor for operation at speeds from 875 to 3500 R.P.M. The shaft sizes are 3/8 inch by 5 feet for the 1/4-H.P. unit, and 1/2 inch by 6 feet for the 1/3-H.P. unit.



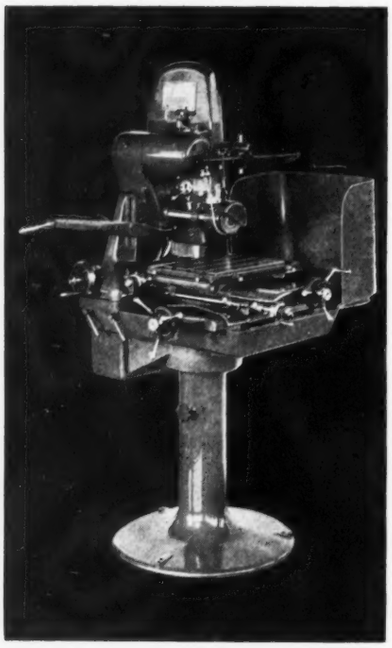
(Left) Oil Reclaimer Recently Brought Out by the Hilliard Corporation

Bergram Bench Type Internal Grinder

A bench type internal grinder suitable for either single-purpose production or for a range of straight, tapered, or beveled holes, has been



(Right) Bergram Bench Type Internal Grinder Recently Placed on the Market



Hertlein Universal Tool Grinder Designed for Quick Set-ups

placed on the market by the Bergram Mechanical Engineering Co., Inc., New Britain, Conn. Change-overs may be quickly made when a variety of work is being handled. The capacity covers holes from 3/16 inch up to 3 inches in diameter.

The machine frame consists of a welded steel column and base which are made in one piece and stress relieved after welding. Table longitudinal and cross feeds are provided, there being a fast longitudinal feed through a rack and pinion, and a slow motion through a screw and graduated dial. The cross-feed is also controlled by a screw and dial.

The wheel-spindles are removably mounted in a bracket attached to the column face. The spindles are interchangeable over a wide range for obtaining speeds from 8000 to 35,000 R.P.M. The drive is through a flat belt from a 1/3-H.P. motor of the universal type which runs at 10,000 R.P.M. The motor is cradled at the back of the column to permit the adjustment of belt tension and to eliminate vibration.

Hertlein Precision Tool Grinder

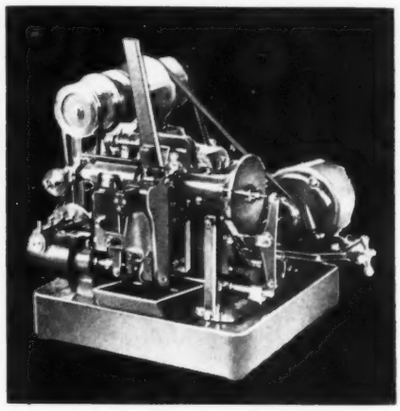
A machine known as the Hertlein universal precision tool grinder, has been brought out by Carl J. Hertlein, 2108 West Fort St., Detroit, Mich. This machine has been designed especially to provide accuracy, ease of operation, and quick set-ups. The machine has five speeds varying from 5000 to 35,000 R.P.M. The drive is from a 1/2-H.P. motor, a separate motor being provided for the coolant pump. The height of the table is 40 inches, the floor space occupied is 48 by 60 inches, and the weight is approximately 800 pounds.

Jones Worm-Helical Speed Reducers

Worm-helical speed reducers designed for continuous operation coupled direct to electric motors are being introduced to the trade by the W. A. Jones Foundry & Machine Co., 4409 Roosevelt Road, Chicago, Ill., in ten standard sizes that provide horsepower capacities as low as 0.47 and as high as 112. Fifteen standard ratios ranging from 40 to 1 minimum up to approximately 250 to 1 maximum are available for each size of unit. The resulting range of capacities covers practically the entire industrial field where this type of reducer can be used advantageously.

Each unit is supplied with an oil pump for providing lubrication to the bearings in the housing cover as well as to the helical gears. This construction permits performance under constant loads with moderate temperature conditions. The pump is mounted on the rear worm bearing cover-plate and is driven directly from the worm, thus permitting operation at the most efficient speeds.

The general design of these worm-helical reducers makes it possible to furnish them in various assemblies. They are also available in different styles of bearing mountings for the vertical low-speed shafts.

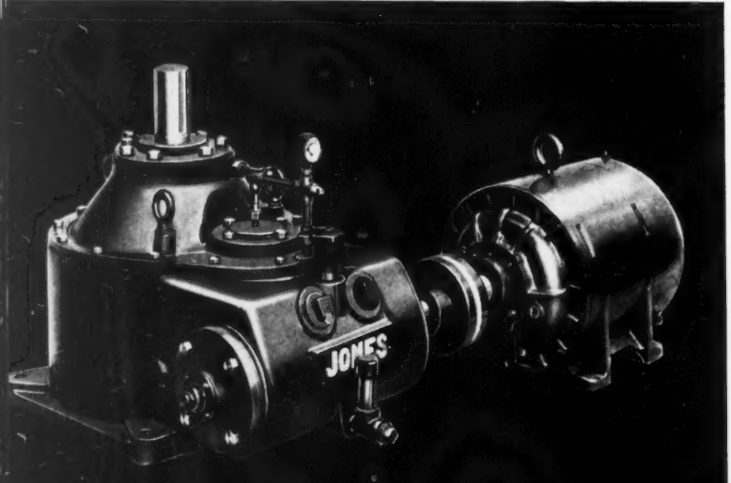


Waltham Machine for Cutting Small Gears and Pinions

Waltham Pinion and Gear Cutting Machine

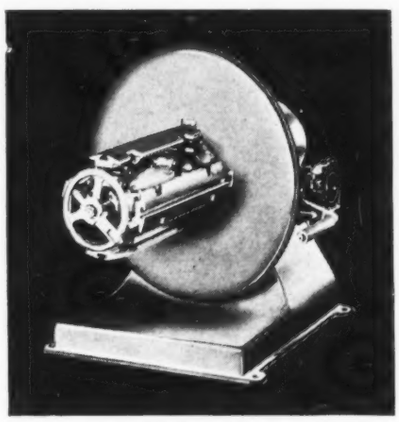
An improved 1 1/2-inch pinion and gear cutting machine equipped with an individual motor drive and arranged for cutting small-diameter fine-pitch pinions has been brought out by the Waltham Machine Works, Newton St., Waltham, Mass. A two-step pulley on the motor shaft provides two speeds for the driving shaft which is connected by means of V-belts to several units of the machine, each belt being tightened by means of an idler pulley.

One revolution of the magazine-operating shaft controls the machine as follows: First the camshaft is stopped, after which the finished pinion is ejected and a fresh blank taken from the magazine is placed in position. The blank is then forced into the driving center by the tailstock spindle. The clutch on the camshaft drive is next re-engaged



Jones Worm-helical Speed Reducer Coupled Direct to an Electric Motor

and the cutting of the new blank begins. All of these movements are completed in one second or less, making it possible to index and finish the return stroke movement in the shortest possible time, thus keeping the cutter at work almost continuously. With this arrangement, the teeth on an eight-tooth instrument pinion can be cut in soft steel at the rate of four per minute. The machine can be used on a bench, the actual space required including all overhanging parts, being 20 by 22 1/2 inches, and the weight approximately 300 pounds.



Littell Automatic Centering Reel for Handling Heavy Coils

Littell Reel for Coils up to 4000 Pounds

The F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill., has recently added to its line of heavy-duty reels a No. 40 automatic centering reel for handling coils 20 inches wide, weighing up to 4000 pounds. This reel is especially adapted for press shops. It is self-centering and particularly suitable for unwinding and rewinding light-gage materials. In thin materials it prevents the rolling of the edges which occurs in cradle type coil reels.

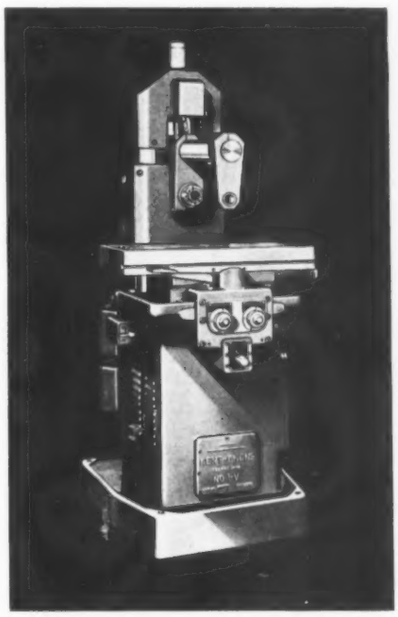
The winding drum is easily expanded by manipulating a hand-wheel; it has a normal expansion range from 14 1/2 to 16 1/2 inches. "Chairs" can be provided for handling larger coils. The reel is mounted on an all-steel welded base, and equipped with a 3-H.P., 1200-R.P.M. motor, driving through an enclosed self-contained worm drive.

Kent-Owens Hydraulic Milling Machine

The combination of a horizontal spindle with an automatic hydraulic vertical head feed is the outstanding feature of a No. 1-V milling machine recently brought out by the Kent-Owens Machine Co., Toledo, Ohio. This machine is especially suitable for milling Woodruff keyways, cutting-off operations, milling tongues and slots in the ends of shafts and similar operations. The vertical feed is particularly applicable to the handling of long pieces held in a fixed position on the table.

The head movement is actuated hydraulically by a separate motor-driven pump mounted in the base. The head has vertical feed in the down direction only and rapid travel in both the up and down direction. Any feed from 1 inch to 80 inches per minute can be obtained.

The spindle is driven by a motor at the rear. There are only two gear sets between the motor and the cutter. One of these is a pair of pick-off gears, by means of which any speed from 100 to 2000 R.P.M. can be obtained.



Kent-Owens Hydraulic Milling Machine with Unusual Features

Lipe Hydraulically Controlled Lathe

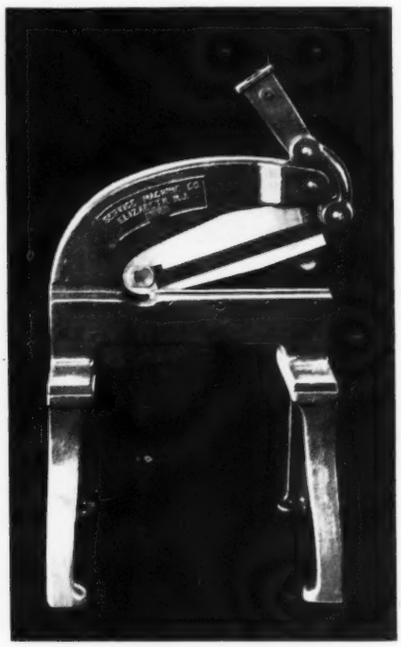
A hydraulically controlled, high-powered lathe, known as the "Carbo-Matic," has been placed on the market by W. C. Lipe, Inc., Syracuse, N. Y. This machine has a number of new features. Its great rigidity can be judged from the illustration. The entire cycle of the machine is automatic. By simply pushing a lever, the spindle starts and the tools advance. After their work is done, the tools automatically recede, the carriage returns to the loading position, and the entire machine stops.

The hydraulic operation applies to the spindle clutch, chuck and collet closers, longitudinal and cross feeds, and tailstock quill. A tilted control panel with pressure gage, ammeter, and push-button control is located in front of the headstock. A time-delay valve controls the front carriage, operated by rack and pinion, which, in turn, is impelled by a hydraulic cylinder. The maximum travel of the carriage is 15 1/2 inches forward or reverse on either side of the center. A double cross-slide operated by a cam bar can be furnished, one for straight cuts and the other for tapered or formed cuts.

Lipe Carbo-Matic Hydraulically Controlled Automatic Lathe

Multi-Miller Brought out by the U. S. Tool Company

Grob Combination Band Sawing and Chain Filing Machine



"Semco" Hand Slitting Shear for Steel up to No. 10 Gage

Automatic Multi-Miller for Small Parts

The U. S. Tool Company, Inc., Ampere, East Orange, N. J., has just placed on the market a new MM-52 multi-miller designed for milling parts for typewriters, small arms, sewing machines, electrical equipment, cameras, airplane engines, etc. This machine is the latest addition to the line of automatic production milling machines made by this company. The automatic vertical feed of the spindle head is cam-controlled. Profiling operations can be performed by synchronizing the cam-controlled vertical feed and the cam-controlled table feed.

One operator can attend to as many as six of these machines, since it is only necessary for him to load and unload the work. A typical cycle consists of quick approach to cutting positions, cut at one level, cut vertical to the second level, cut at the second level, raise spindle to clear the work and quick return to the loading position. Any contour within the range of the 2-inch vertical motion and the 6-inch table movement can also be milled. The machine is arranged for a 1-H.P. motor.

Grob Band Sawing and Chain Filing Machine

A combination band sawing and chain filing machine on which the band saw and file chain run over separate tracks, has been designed by Grob Bros., Grafton, Wis. This machine has a throat depth of 24 inches. The pulleys are provided with inlaid rubber bands for the operation of the saw blade and with a groove for the file chain beside the rubber-band track. The file chain is driven positively by the lower pulley, so that little tension is required in the file chain and long life insured.

By tracking the saw blade and file chain beside each other, a change from sawing to filing, or vice versa, can be accomplished in less than a minute. The saw guides and file attachments can be left on the machine at all times. The tension of the saw blade or file chain is adjusted through the hand-crank at the upper right-hand side of the machine. A butt welder on the left-hand side provides for quickly welding saw blades in internal cutting operations. Five saw-band and file-chain speeds from 60 to 375 feet per minute are provided.

"Semco" Hand Slitting Shear

A hand slitting shear for use on sheet steel up to No. 10 gage in thickness has been added to the line of utility equipment manufactured by the Service Machine Co., 162 Miller St., Elizabeth, N. J., for use especially in jobbing sheet-metal stamping plants.

Corrugated or special shapes of sheet steel such as flashing can be cut by substituting special blades for those regularly provided. The standard blades are made from high-chromium steel, insuring long service. They are jig drilled, so as to be interchangeable or replaceable. The length of the blade is 16 inches. The weight of the machine is about 475 pounds.

The company has also added a new size multi-unit punch to its line, designated No. 13 1/2 A. These punches are intended for use on press brakes having strokes up to 5 inches. They are designed to pierce up to 11/16-inch diameter holes in 1/2-inch mild steel. The minimum center-to-center distance of the units is 2 1/2 inches. A recent installation consists of twenty-eight units.

Root Hydraulic Boring and Drilling Machine

A boring and drilling machine designed and built for use in arsenals, box factories, navy yards, railway car and auto body shops, and similar plants requiring a heavy and powerful machine for wood boring has been brought out by the B. M. Root Co., York, Pa. The multiple-spindle speeds and hydraulic feed also make this machine suitable for drilling aluminum, bronze, plastics, fiber, and similar high-density materials. It can be equipped with multiple-spindle fixed-center or adjustable-center boring heads.

The spindle unit is equipped with a constant-horsepower, two-speed motor. The motor housing has an adapter for multiple boring heads.

The hydraulic feed moves the motorized spindle unit toward the table. Two to thirty-five continuous or intermittent strokes per minute are obtainable. The boring spindle can be stopped or reversed at any point by a foot-trip. The maximum distance from the spindle nose to the table is 24 inches, and the distance from the center of the spindle to the column is 18 inches.

Minster Horning and Wiring Presses

The machine here illustrated is one of a number of horning and wiring presses of new design built by the Minster Machine Co., Minster, Ohio, and installed recently in a Detroit automobile plant. The press has a capacity of 71 tons, and is equipped with an electrically controlled air-operated combination friction clutch and brake.

The press frame is of heavy cast semi-steel construction, and is so designed that an adjustable swinging table can be used. When thus equipped, the press has the capacity and most of the advantages of a gap type machine, in addition to its regular horning and wiring features. The opening in the frame will accommodate a horn shank 7 inches in diameter.

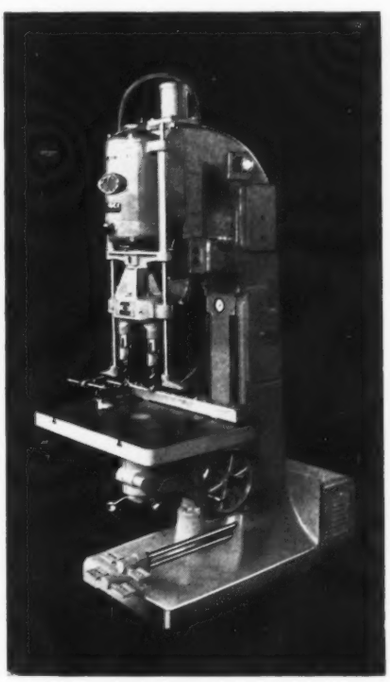
The 10 series of this machine is built in eight sizes, ranging in capacity from 12 to 88 tons. The sizes 10 to 6 and smaller have as standard equipment the Minster multi-engagement spline clutch. One of the features of this clutch is that the clutch wheel is mounted on tapered roller bearings.

V & O Inclinable Press with New Features

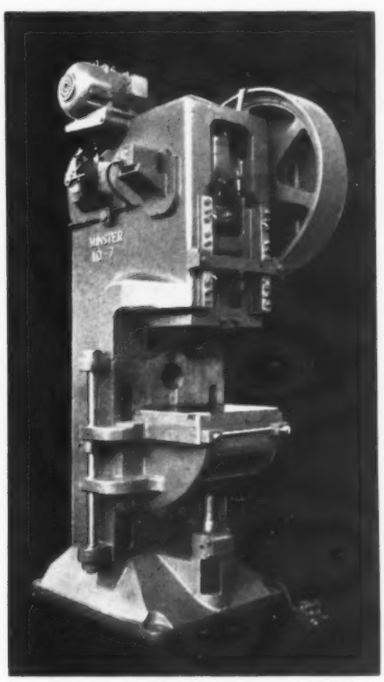
A new design of inclinable press incorporating several completely new features has been brought out by the V & O Press Co., Inc., Hudson, N. Y. This machine is provided with a newly designed, ball-actuated, self-energizing friction clutch, giving an infinite number of engaging points, overload relief, smoother action, and backing-up provision; it can be operated at much higher speeds than formerly, resulting in greater production. A panel is provided for centralized control of the built-in clutch lock, the single-stroke clutch (which is adjustable for continuous operation), and the fully releasable or constant brake.

The machine also has greater rigidity, more bed area, wider and heavier flange slide, more slide adjustment, safer inclining mechanism (operated from the front of the press), and easier treadle action than former models. It is provided with one-shot lubrication system, improved loop type safety guard, and ball-bearing mounted web type flywheel. The press is also arranged for tie-rods with spacing tubes.

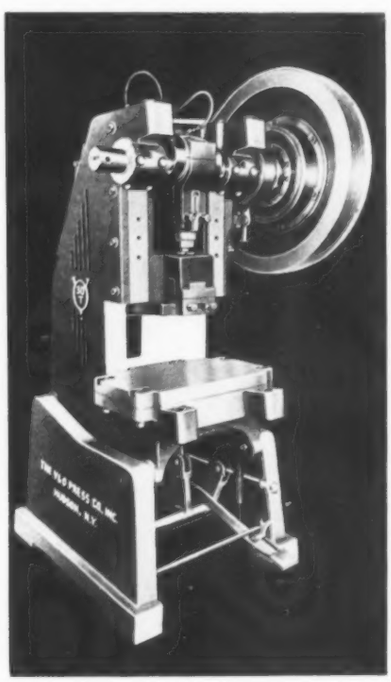
Boring and Drilling Machine Made by B. M. Root Co.



Minster Horning and Wiring Press of 71 Tons Capacity



V & O Inclinable Press with Many New Features



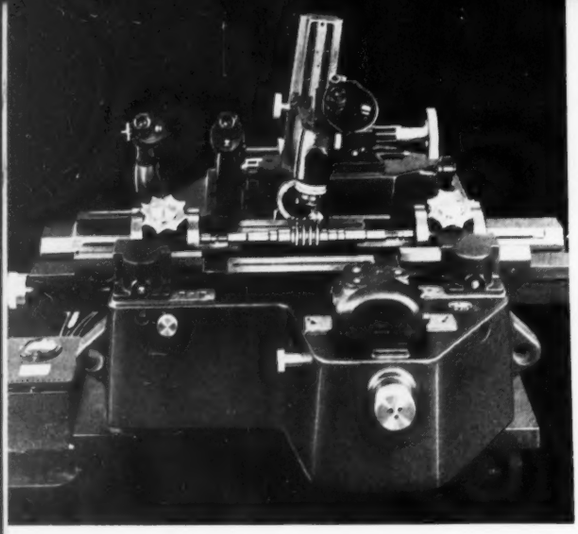


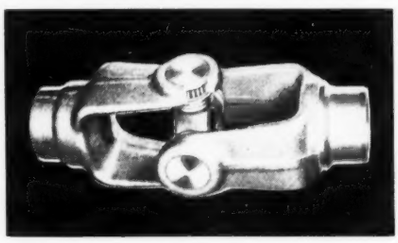
Fig. 1. Zeiss Universal Measuring Microscope Reading to 0.00005 Inch on Glass Scales

Zeiss Measuring and Inspection Machines

Carl Zeiss, Inc., 485 Fifth Ave., New York City, has recently introduced a new universal measuring microscope and a gear "Orthotest." The universal measuring microscope (Fig. 1) has a range of 8 by 4 inches and is intended for the highly accurate measuring of screw thread gages, lead-screws, chasers, hobs, taps, and worms by the knife-edge method. The instrument is equally applicable to the inspection of cylinders, tapers, templets, forming tools, and jig work. The readings are made on glass scales to 0.00005 inch by means of microscopes.

The gear Orthotest (Fig. 2) is a versatile instrument which has been developed to meet the need for a speedy and accurate means of checking the uniformity of pitch and concentricity of spur, helical, spiral, worm, and bevel gears up to 6 inches in diameter. The instrument is especially suitable for checking small gear assemblies, like differentials, with the purpose of separating the errors in the gears from errors in the assembly itself. The indicator reads to 0.00005 inch.

Fig. 2. Zeiss Orthotest for Checking Uniformity of Pitch and Concentricity of Gears



Mechanics Universal Joint for Wide-angle Operation

Roller Bearing Universal Joints

A new roller-bearing universal joint designed for wide-angle operation has been brought out by the Mechanics Universal Joint Division, Borg-Warner Corporation, 1900 Harrison Ave., Rockford, Ill., in three standard sizes rated at 10, 20, and 30 H.P., respectively, at 550 R.P.M. These units are made with yokes designed to fit all types of applications. For most installations, this new joint is packed with sufficient grease during assembly to last for the entire life of the joint. As no grease fitting is employed, the joint can be completely covered with a guard. For extremely severe service, however, it is sometimes advisable to incorporate a grease fitting.

It is stated that this new universal joint has an efficiency of over 99 per cent when operating at an angle of 15 degrees. The angular capacity of this type joint is 90 degrees, and it will operate satisfactorily at angles up to 42 degrees at 550 R.P.M. Joints of this type can be furnished complete with drive-shaft and safety slip clutches and slip joints.

Eastern Machine Screw Corporation Threading Machine

A new type of threading machine developed by the Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven, Conn., which is designed especially for high-class threading, as for aircraft parts, is shown in the illustration. The hardened and ground spindle is equipped with roller and ball thrust bearings. The tailstock is of the collet type. All the electrical equipment, as well as the oil pump and oil reservoir, is placed in the base. Although of a smooth, streamline design, the machine is provided with suitable shelves for holding gages, micrometers, etc.

Several improvements have been made in the standard line of the company's two-spindle threading machines, and the motor, pump, cutting oil reservoir, and all electrical equipment have been placed in the base.

New Type Threading Machine Built by the Eastern Machine Screw Corporation

The company has also brought out a No. 000 die-head. This is extremely small, weighing only 3 ounces. The capacity of the head is from 0 to 1/4 inch. The maximum diameter of the head itself is 1 1/8 inches.

Rasmussen Sawmore Machine which can Cut through 10 to 15 Square Inches of Steel per Minute

Alternating-Current Arc Welders

A new alternating-current arc welder has recently been placed on the market by K. O. Lee & Son Co., Aberdeen, S. D. This welder is made in three models having capacities ranging from 20 up to 150, 200, and 250 amperes, respectively. All three models are regularly built to operate on 220-volt, 60-cycle current, but can be furnished for 440-volt, 60-cycle current when desired.

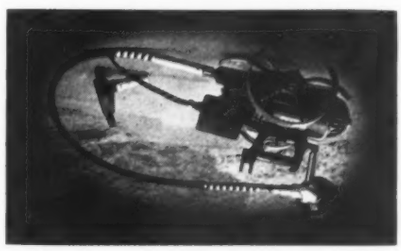
The smallest size is suitable for sheet-metal work in automobile body and fender shops and garages or other work which does not require electrodes over 5/32 inch diameter.

The intermediate size is adapted for general purpose welding in production and repair shops, while the largest model is particularly suited for job shops handling heavy welding work. This machine handles 1/16- to 1/4-inch electrodes and consumes a maximum of 7.5 kilowatts per hour.

Alternating-current Arc Welder Brought out by K. O. Lee and Son Co.

Mall Flexible Shaft Grinder

A flexible shaft grinder mounted on two wheels for ready portability is a new product of the Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill. This equipment is provided with



Wheel-mounted Flexible Shaft Equipment

a geared head and is driven by a 3-H.P., three-phase, 60-cycle motor operating on 220- or 440-volt current. The machine is designed for a flexible-shaft or grinding speed of 5500 R.P.M., and it can be supplied for 25- and 50-cycle current. The wheels may have either steel rims or pneumatic tires.

Rasmussen "Sawmore" Metal-Cutting Machine

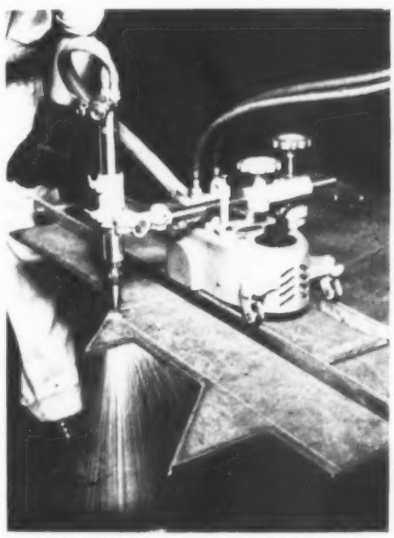
From 10 to 15 square inches of steel can be cut per minute by means of a new "Sawmore" metal-cutting machine brought out by the Rasmussen Machine Co., Inc., 1 Main St., Racine, Wis. Like previous machines of the same line, this model can be swiveled on its base for cutting angles. The stock remains in the same line, whether cutting straight or to angles, and hence the machine can be installed close to a wall or aisle. Angular sawing is also fully automatic.

The machine has a positive compensating feed which allows faster cutting as the saw blade encounters less metal. This feed is adaptable to two-tooth blades. Gaging of the length of cut is accomplished by means of a spacer bar and scale mounted on the side of the carrier. It is said that stock can be readily cut to length within 0.002 inch. This gaging arrangement eliminates possible blade breakage.

Portable Oxy-Acetylene Cutting Machine

The National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill., will introduce its new streamline

National Portable Motor-driven Oxy-acetylene Cutting Machine



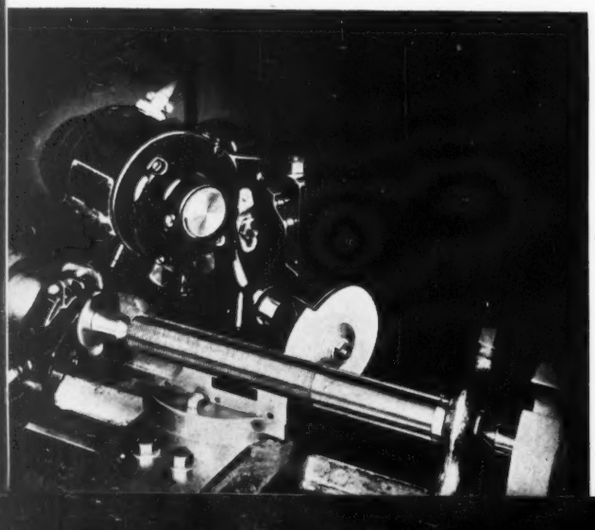
No. 5 portable cutting machine at the National Metal Exposition in Chicago. This light-weight motor-driven oxy-acetylene cutting machine is designed for cutting metal along straight lines of any length, with either a square or beveled edge. It also cuts circles ranging from 3 to 89 inches in diameter with a square or beveled edge, and irregular outlines to a limited degree. Features of this improved machine are better balance, more efficient motor insulation, and more convenient controls.

Dumore Thread-Grinding Attachment

An attachment for grinding threads in a lathe has been developed by the Dumore Co., Racine, Wis., for application to the No. 5 portable precision grinder manufactured by that concern. A typical operation performed with this attachment is shown in the illustration. The equipment includes a steel carrying case, mounting post for a No. 5 grinder, wheel-dressing attachment, set of fine and coarse grinding wheels, wheel guard, and steadyrest for the dressing attachment.

The regular unit is built for grinding American standard and other standard threads, but an attachment can be supplied to dress wheels for grinding Acme and special threads. The wheel can be conveniently set as required for grinding to desired helix angles.

In operation, the manufacturer recommends that a slow work speed be used wherever possible and the operation should preferably be performed in the same lathe as that in which the thread was cut. For fine pitches, the finer of the two wheels furnished is used; for coarse pitches and roughing cuts, the coarse wheel is used.

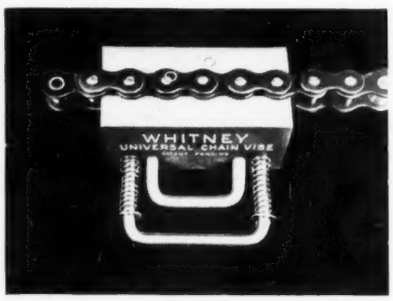


Dumore Thread-Grinding Attachment being Applied to Work Revolved in a Lathe

Whitney Universal Chain Vise

The universal chain vise here illustrated has been developed by the Whitney Chain & Mfg. Co., Hartford, Conn., to simplify the disassembly of roller chains in pitches from 5/8 inch to 2 1/2 inches, and in single and multiple widths. This tool holds the chain by spring action, so that both of the workman's hands are free for the disassembly operation. The chain parts cannot be damaged.

Among the advantages of this vise may be mentioned the following: One tool handles a great many different sizes of chain; it is of light weight, portable, and operated by one hand; it is completely self-contained with no loose parts; the vise can be used as an anvil, no other support being required when hammering, since the weight of the vise is sufficient; and there is no chain tilting, as the vise grips several links and maintains their alignment during the disassembly operation. The roller link plates are supported at four points, preventing distortion,



Whitney Universal Chain Vise

which is of importance on cotter-pin type chain where the links are reused. The vise can also be used for riveting new links in place.

Tapping Machine Equipped to Prevent Tap Breakage

Procunier Air-Operated Tapping Machine

An outstanding feature of the new "Universal" tapping machine brought out by the Procunier Safety Chuck Co., 16 S. Clinton St., Chicago, Ill., is an air-operated unit designed to control production and accuracy and to eliminate tap breakage. Compressed air serves to actuate the tapping head in both the drive and reverse directions, and adjustable compensating springs assure uniform tapping pressures, in driving the tap forward and in backing it out. Should the tap become jammed in the hole or should the hole not be lined up properly with the tap, the air unit completes its cycle without damage to the work or tap.

This machine will operate taps in sizes from No. 2 to 5/16 inch in diameter in steel, 3/8 inch in cast iron, and 1/2 inch in brass. The spindle travel is adjustable from 1/4 inch to 3 3/4 inches by means of a trip-arm.

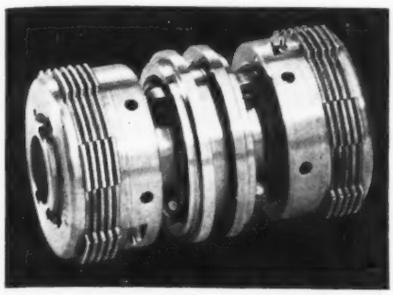


Fig. 1. Twin Disc Model MT Duplex Clutch

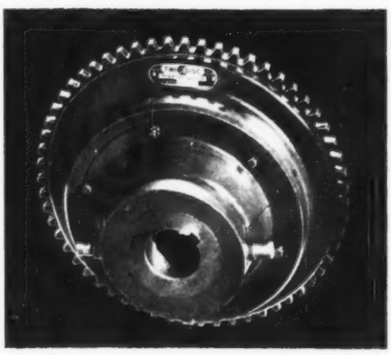


Fig. 2. Twin Disc Model CL Clutch

Twin Disc Machine Tool Clutches

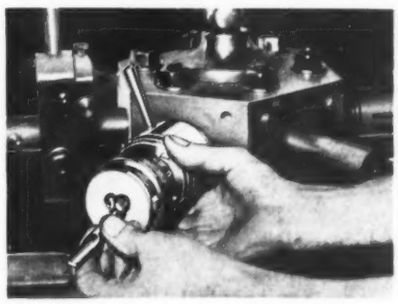
The Twin Disc Clutch Co., 1324 Racine St., Racine, Wis., has brought out two new types of clutches especially designed for machine tools. Among these are the Model MT clutch (Fig. 1) and the CL clutch (Fig. 2). The new Model MT clutch, because of its relatively high torque capacity and the comparatively low operating pressure required, is particularly well suited for machine tools and similar mechanisms. It is available in both single and duplex models, with each model made in two types—one for "dry" operation, and one for "in oil" enclosed operation. The duplex model consists of two single clutches having a common engaging cone and operating lever. It can be used as a two-speed drive, or one of the clutches can be used as a brake or as a power reverse drive.

The oil type clutches are particularly suited for use where frequent clutch engagement is required. The dry type clutches are best suited for conditions where a compact clutch of high torque capacity is needed for cut-off clutch service. They can also be used as operating clutches where frequent use does not demand a clutch of the oil type.

The Model CL clutches are designed to meet the need for a heavy-duty enclosed type clutch in sizes from 5 1/2 to 16 inches in diameter. The 5 1/2-, 6 1/2-, and 7 1/2-inch sizes are available only in single-plate construction; the 8-, 10-, and 11 1/2-inch sizes are available in one-, two- or three-plate construction; and the 14- and 16-inch sizes in one- and two-plate construction. These clutches are applicable to line-shafts and pulley drives, and are suitable for use with driving spiders carrying gears, sprockets, or pulleys. They are available both in single and duplex construction.

Rickert-Shafer Collapsible Tap

The Rickert-Shafer Co., Erie, Pa., announces a new collapsible tap designed to facilitate rapid set-up and quick change of chasers. The same tool serves for either stationary or live-spindle use with taps of all diameters down to 1/2 inch.



Rickert-Shafer Collapsible Tap

Only a quarter turn of the locking ring is required to release the chasers, and a new set of chasers can be inserted in a few seconds. The holder is set for tripping from the front end by a short turn of the micro-adjusting trip-ring. The exact length to be cut can be scaled and the holder set instantly to trip at the desired length.

This tap is intended for use where accurate, standard-size threads are to be cut to close limits. A visible adjustment on the holder permits quick and exact compensation for chaser wear.

Arc Welders Recently Announced by the Lincoln Electric Co.

A 300-ampere Diesel-engine driven arc welder which is started by a gasoline engine instead of a conventional motor starter equipped with storage batteries has been brought out by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. The gasoline starting engine is a small auxiliary mounted above the Diesel engine. Starting in extreme weather is facilitated by the fact that the cooling system of the starting engine is connected with the cooling system of the Diesel engine. This makes it possible to warm up the Diesel engine by running the starting engine for a short time.

The Diesel engine compares favorably with gasoline engines in dependability of starting, simplicity, weight, cost, and operating speed. Fuel costs are said to be cut from 33 to 86 per cent, depending on the type of fuel oil used. The arc-welding generator is the 300-ampere Shield Arc S A E unit. This welder is illustrated in Fig. 1.

A small arc-welding machine designed for the average machine shop, job welding shop, contracting

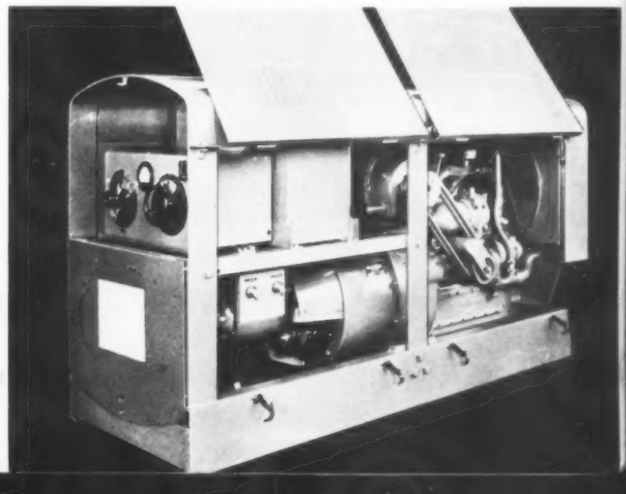


Fig. 1. Lincoln Diesel-engine Driven Arc Welder with Gasoline Starting Engine

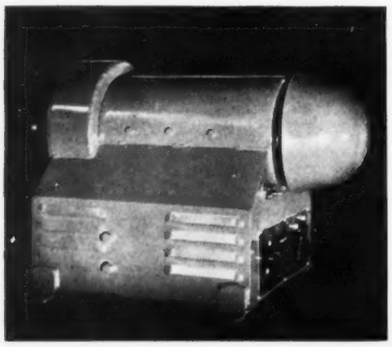


Fig. 2. Lincoln Small Welder Designed Especially for Use in the Average Shop

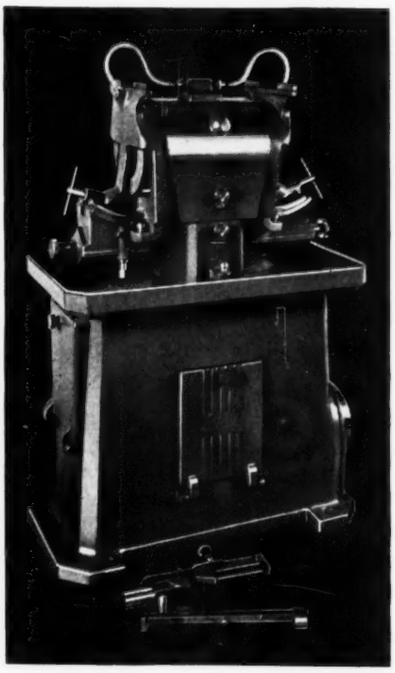
shop, garage, or blacksmith shop, has also been developed by the Lincoln Electric Co. This welder (Fig. 2) is known as the "Shield-Arc Junior," and is built for use in conjunction with an engine or electric motor drive. It can be direct-coupled to a gasoline engine or belted to a power take-off from the engine; it can also be connected by belt to lineshafting or to an electric motor. The welder is rated at 200 amperes, and its current range, welding duty, 30-volt arc, is from 60 to 250 amperes.

The system of control known as "dual continuous" control, now available for the first time on a small belt-driven model, permits independent adjustment of voltage and current.

Oliver Templet Tool-Bit Grinder

The tool-bit grinder shown in the illustration has been developed by the Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich., to automatically produce any required shape on a standard tool bit up to 3/4 inch square. A holder for the tool to be ground, resting on a ball and socket joint at its lower end, has at its upper end a double-size templet giving the exact shape of the tool form. The tool-holder is placed on a ball which forms a part of the wheel guard. The templet is held so it can come in contact with a straightedge, which is also part of the wheel guard. The tool is rocked against the wheel until the templet comes in contact with the straightedge, when no more metal can be ground from the tool. The machine has a roughing and a polishing wheel. After the metal has been removed by the roughing wheel, the tool is transferred to the polishing wheel to give it a very fine finish.

The trouble and expense of providing a templet are reduced by a special holder in which a tool of the shape desired can be inserted in order to grind the templet to its exact shape, which is done simply by rocking the tool against a steel form. The templet is then placed in the regular tool-holder to reproduce the tool shape from which it was made. Any required degree of clearance can be obtained by tipping the wheel guard in relation to the wheel. Adjustment is provided for this, and the clearance is indicated on a graduated scale.



Oliver Tool-bit Grinder which Automatically Produces Desired Shapes

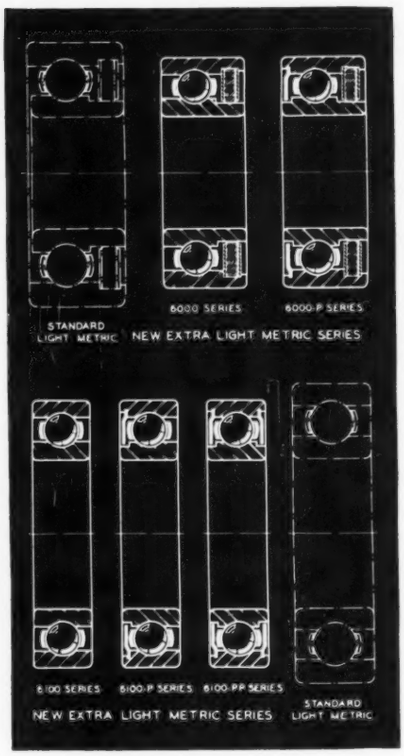
Norma-Hoffmann Extra-Light Ball Bearings

The Norma-Hoffmann Bearings Corporation, Stamford, Conn., announces two new series of extra-light ball bearings designated 6000 and 6100. These bearings are especially intended for use in portable tools and other small high-speed units in which minimum weight, restricted center distances, and compactness are essential.

Cross-sectional views of five types of bearings in the new series are shown in the illustration, together with a cross-section of a standard light ball bearing for purposes of comparison. It will be observed from the drawings that for a housing of given diameter, the bearings of the new series permit the use of a shaft of larger diameter. Similarly, for a shaft of given diameter, the new bearings permit the use of a housing that is considerably smaller in diameter.

In the 6000 series felt-sealed bearing, which is furnished with a single felt seal as Type 6000 or with a felt seal and side plate or shield as Type 6000-P, the sealing devices are entirely within the confines of the bearing and, therefore, are not exposed to injury. The bearings of

Extra-light Ball Bearings Contained in Norma-Hoffmann 6000 and 6100 Series



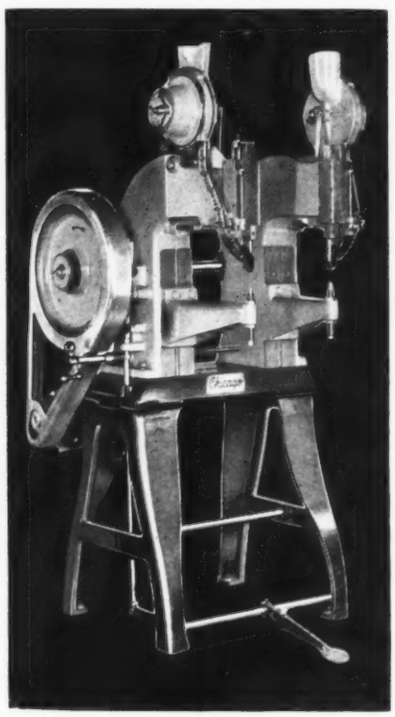
this series are obtainable in bores up to 25 millimeters.

The 6100 series is already available with bores in sizes up to 45 millimeters. These bearings can be supplied without a side plate or shield, in which case they are designated as 6100, with one side plate as 6100-P, and with two side plates as 6100-PP.

Chicago Automatic Rivet-Setter

The Model 82 automatic rivet-setter shown in the illustration has just been brought out by the Chicago Rivet & Machine Co., 1830 S. 54th Ave., Chicago, Ill. This machine sorts, feeds, inserts, and clinches steel tubular rivets up to 1/4 inch. It is provided with a double riveter head having adjustable centers. Provision is also made for raising and lowering the anvil, so that a single unit can be used on a wide range of assembly applications. Hence, features heretofore confined to machines for setting smaller rivets have been incorporated in the present larger heavy-duty model.

Automatic Heavy-duty Rivet-setter Built by the Chicago Rivet & Machine Co.



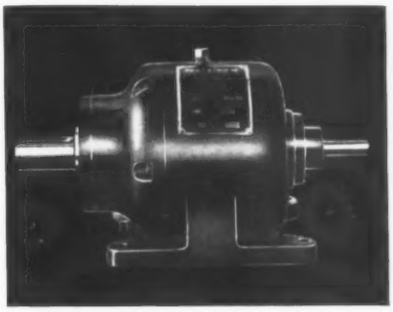
Palmgren Quick-Change Safety Drill Chuck

Drills can be changed in complete safety without stopping the drilling machine through the use of a new chuck introduced by the Chicago Tool & Engineering Co., 8389 S. Chicago Ave., Chicago, Ill. The drills are instantly released by a slight upward movement of a free-moving knurled sleeve, as indicated in the illustration. In addition to the easy-insertion and quick-releasing features, the chuck is so designed that the drills can be gripped tighter for heavy-duty operations by merely screwing up the outside shell. Even after tightening the grip in this manner, the drills can be released instantly, as described. This new chuck is made in 1/4-, 3/8-, 1/2-, 5/8-, 3/4-, and 1-inch sizes. Each size takes a wide range of drills.

Palmgren Chuck in which Drills can be Changed without Stopping the Machine

Smith Speed Reducer

A new size of speed reducer has been added to the line of the WHS differential speed reducers made by Winfield H. Smith, Inc., Springville, Erie Co., N. Y. The new unit, known as the No. 7, has anti-friction bearings throughout, including Timken bearings on both the high-speed and low-speed shafts. Reduction ratios up to 20,000 to 1 are obtainable, with torque capacities from 2000 to 5000 inch-pounds.



Differential Speed Reducer Placed on the Market by Winfield H. Smith, Inc.

Hall New Type Arbor

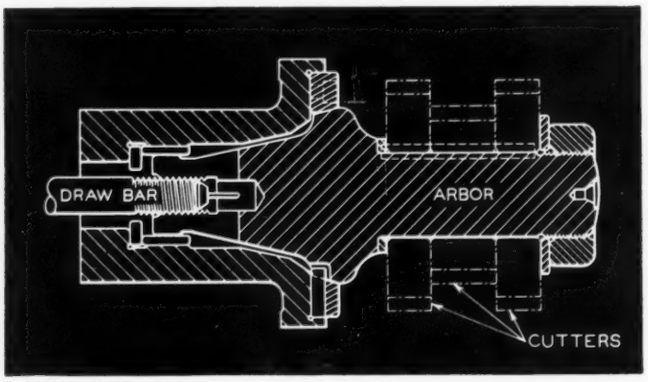
A new type of arbor for milling machines has been developed by the Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia, Pa. In designing this arbor, four points have been kept in mind: First, the arbor must be firmly seated and run true; this has been accomplished by seating the arbor in a narrow taper at the front end and in a straight bore at the rear end. Second, the arbor must be driven in a simple manner; this has been accomplished by using a straight key. Third, the arbor must be mounted in such a way that different sizes can be used without entailing appreciable expense; this has been accomplished by using taper seats of different diameters. Fourth, the design must be such that extreme accuracy is not required in its manufacture, while accuracy in mounting the arbor is assured.

The illustration, which shows the mounting of the arbor, is practically self-explanatory. The front end of the arbor has a narrow taper which forms the front seat in a plate or ring fastened to the end of the spindle. The rear end has a straight shank which is a sliding fit in a hardened, replaceable bushing. This

portion of the arbor is split in four sections to allow for slight expansion and thus obtain a tight fit in the bushing. The expansion is caused by the slight taper of the threaded portion of the draw-bar. The arbor is pulled firmly against its tapered seat by the draw-bar, making it impossible for it to rock or run out.

In some cases, it is desirable to use smaller arbors. This can be done without appreciable expense, since a smaller sized arbor will only require the use of a smaller sized plate or ring at the end of the spindle.

Renewals due to wear are easily made at small cost without impairing the accuracy of the original set-up. This type of arbor can be made without the use of expensive gages.



View Showing Principles Involved in the Design of the Hall Arbor

Index of New Equipment

Acme Roll-Threading and Forging Machines 122
Acme Turret Lathes 77
Ajax Cold-Drawing and Straightening Machine 116
American Broaching Machines 94
Arter Rotary Surface Grinder 129
Avey Drilling Machines 75
Barber-Colman Hobbing Machine... 106
Bergram Internal Grinder 137
Bliss Press Brake 112
Buffalo Forge Drill, Universal Iron Worker, and Bending Roll 125
Bullard Vertical Turret Lathe and Mult-Au-Matic 98
Chicago Rivet-Setter 147
Cimatool Gear-Tooth Chamfering and Burring Machines 113
Cincinnati-Bickford Jig Boring Machine and Radial Drill 87
Cincinnati Milling Machines 81
Cincinnati Shapers and Shears 119
Cincinnati Vertical Boring Mill 83
Clark Portable Grinder and Drills .. 137
Clearing Hydraulic Presses 68
Cleereman Jig Borer and Drill 70
Cone Conomatic Screw Machine ... 77
Consolidated Newton Mill-N-Shaver 123
Continental Doall Machine 118
Dawes Centrifugal Clutch 113
Dumore Thread-Grinding Attachment 144
Eastern Threading Machine 142
Ex-Cell-O Grinding Spindles and Hydraulic Power Units 136
Ex-Cell-O Thread-Grinding and Internal Lapping Machines 104
Fosdick Drilling Machines 80
Foster Fastermatic and Screw Machine 116
Frew Duplex Hand Milling Machine 133
Gallmeyer & Livingston Grinders... 80
Gardner Disk Grinding Machines... 92
General Electric Time Starters 125
Giddings & Lewis Boring Machines.. 69
Gisholt Automatics and Balancing Machines 92
Gleason Gear and Pinion Grinder... 111
Goss & DeLeeuw Chucking Machine 133
Gould & Eberhardt Hobbing Machine and Shaper 94
Gray Planer 131
Greenlee Automatic Screw Machine 89
Grob Sawing and Filing Machine ... 140
Hall Milling Machine Arbor 147
Hanchett Grinders 82
Hardinge Precision Lathe and Second-Operation Machine 105
Haskins Tapping Machines 75
Hendey Toolmaker's Lathe 128
Henry & Wright Dieing Machine .. 134
Hertlein Tool Grinder 138
Hilco Oil Reclaimer 137
H-P-M Presses 130
Ideal Motor Base 136
Jones & Lamson Fay Automatic, Turret Lathe, and Thread-Grinder .. 128
Jones Speed Reducers 138
Kearney & Trecker Milling Machines 99
Kent-Owens Milling Machine 139
Keuffel & Esser Tracing Paper 106
Knight Vertical Milling Machine ... 87
Landis Grinding Machines 74
Landis Threading Machine 118
LeBlond Lathes and Cutter Grinders 117
Lee Arc Welders 143
Leland-Gifford Drilling Machines ... 124
Lincoln Arc Welders 145
Link-Belt Speed Transmission 101
Lipe High-Powered Lathe 139
Littell Reel for Coils 139
Lucas Horizontal Boring Machine... 89
Mall Flexible Shaft Grinder 143
Mattison Surface Grinder 95
Mechanics Universal Joints 142
Michigan Gear-Finishing Machine .. 107
Micromatic Hydrohoner 119
Minster Horning Presses 141
Monarch Lathes 76
National Acme Chucking Automatic 88
National RotoMill and RotoShaving Machine 110
National Gas Cutting Machine 143
New Britain Automatic Screw Machine and Chucking Machine..... 106
Niles Lathe 122
Norma-Hoffmann Ball Bearings 146
Norton Grinding and Lapping Machines 100
Oakite Cutting Oil 105
Oilgear Broaching Machines 86
Oliver Tool-Bit Grinder 146
Oster Portable Pipe Machine 129
Palmgren Safety Drill Chuck 147
Procunier Tapping Machine 144
Racine Metal-Cutting Machine 71
Rasmussen Metal-Cutting Machine.. 143
Rickert-Shafer Collapsible Tap 145
Rivett Bench Lathes 101
Rockford Vertical Shaper 131
Root Boring and Drilling Machine.. 141
Sebastian Geared-Head Lathes 129
Semco Hand Slitting Shear..... 140
Sidney Lathes 123
S K F Double-Row Roller Bearings.. 136
Smith Speed Reducer 147
Stow Flexible Shaft Machine 137
Sundstrand Milling Machines..... 134
Taft-Peirce Surface Grinder..... 135
Triplex Jig Boring, Gear Grinding, and Centerless Grinding Machines 132
Twin Disc Clutches 145
U. S. Tool Co. Multi-Miller 140
V & O Inclinable Press 141
Van Norman Milling Machines 112
Walker Surface Grinder 83
Waltham Gear Cutting Machine ... 138
Warner & Swasey Turret Lathes .. 111
Westinghouse Electric Equipment.. 110
Whitney Chain Vise 144
Zeiss Measuring Machines 142

The Twenty-First Annual National Metal Exposition

CHICAGO, OCTOBER 23-27

THE twenty-first National Metal Congress and Exposition, held under the auspices of the American Society for Metals, opens in the International Amphitheater, Chicago, Monday, October 23, and continues through Friday, October 27. More than 200 exhibitors have reserved space for the Show, and four national societies will hold meetings in conjunction with the National Metal Congress.

The Chicago International Amphitheater provides an excellent setting for this large exhibition of metals and materials. The Show will afford plant executives, superintendents, metallurgists, and engineers a most unusual opportunity to study and compare new products, processes, and materials, many of which are displayed to the industry for the first time. The exhibition, which has become an annual institution of the metal industries, includes not only iron, steel, and non-ferrous metals, but also materials of every kind, such as the newly developed synthetic plastics.

The exhibition includes a wide variety of equipment for the welding, cutting, heat-treating, inspecting, and testing of metals. There will also be a great deal of machine shop equipment and machinery, cutting and lubricating oils, precision tools and instruments, refractories, abrasives, and rustproofing compounds. Many of the exhibits will be shown in operation, and some interesting working models will be on display.

As in the past, the American Society for Metals will hold its annual meeting at the time of the exposition. An extensive program of papers and lectures has been arranged for this meeting. In all, there are over fifty papers to be presented, many of them by nationally known metallurgists and engineers. Almost every phase of the metallurgy of ferrous and non-ferrous metals will be dealt with.

The American Welding Society also holds its annual meeting in conjunction with the exposition. The headquarters for this meeting will be at the Stevens Hotel. Some sixty technical papers have been scheduled to be presented at fifteen sessions, held each day from Monday to Friday. The subjects to be discussed will cover practically every important problem in the welding field.

Another extensive program of papers has been prepared by the Iron and Steel Division and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, which divisions will also hold meetings during the first two days of the exposition. The Wire Association, another of the four societies that will take part in the Metal Congress, holds meetings during the first four days, at which numerous papers covering subjects of interest in the field of wire manufacture and application will be presented. Both as an exhibit of materials and equipment, and as a meeting of metallurgists and engineers to consider their problems, the Metal Exposition and Congress promises to be a notable event.

EDITORIAL COMMENT

THE initiative and enterprise of the machine tool industry in constantly developing new equipment for performing machine shop work more accurately and at less cost are too well known to require emphasis. In this number of MACHINERY are illustrated and described a very large number of new and improved machines just placed at the service of the manufacturing industries in general. Here manufacturing executives will find information that can be put directly to use in their shops to yield immediate dividends. Here they will find described new machines that are of immediate importance to the entire mechanical engineering industry.

TO those, however, who look beneath the surface of things to see what makes the wheels go around in the complicated mechanism of civilization, the imposing array of machines illustrated and described has an added significance. It stands as an impressive symbol of social progress, because these machines offer the very means by which this nation can steadily advance to a greater prosperity and a higher standard of living.

EVENTUALLY the ideas represented in these new machines will be translated into new, better, and lower-priced products. It is in this way that demand is stimulated, sales volumes expanded, production increased, and more people employed. With the expanded markets that come with lower prices, a larger number of consumers are brought within the range of products they previously could not afford; new comforts are placed within their grasp. The way has been opened for another step to be taken, giving renewed impetus to the movement that has steadily carried forward the living standards of this country to a level far above that of any other nation.

TO realize what happens to the standards of living in a country that has never been blessed with the "evils" of labor-saving machinery, we have only to look at the condition of the Chinese coolies and their mode of life. These people have employment—plenty of it. But that is the only thing of which they have plenty. They have no leisure and very little food. Why? Because without the help that mechanical genius has developed, man's struggle against nature is a bitter and exhausting battle, in which he is able to gain but a bare existence.

WHAT the achievements of the mechanical industry have meant to the social progress of this country is strikingly illustrated by the fact that from 1870 to 1936 the working hours per week have been reduced by one-third, while the goods that can be bought with the wages of this shorter working week have increased more than two and one-half times; and, contrary to popular belief, there has also been a steady increase in the rate of industrial employment.

DOWN through the years, mechanical genius has been gradually developing the means of lifting man out of a condition of bondage to one of increasing freedom from manual labor, creating a steady increase in employment, and providing, with new comforts, the leisure in which to enjoy them. The new machines presented in this number of MACHINERY offer convincing testimony that the engineers of today are doing their job well.

"Machinery" Wins First Prize for Editorial Achievement

MACHINERY won distinguished honors on September 22 at the Seventeenth Conference of the National Industrial Advertisers Association in New York City, by being awarded one of the two first prizes for the best series of articles published during the year ending August first. Over 100 magazines competed for this award in a contest conducted by "Industrial Marketing." The prize was awarded in recognition of the November, 1938, and July, 1939, numbers of MACHINERY which were published as a contribution to the National Defense Program of the United States Government.

THE inscription on the plaque reads as follows: For Editorial Achievement 1939. First Award to MACHINERY for the best series of articles or editorials published during the twelve months ending August 1, 1939, in the second annual competition conducted by "Industrial Marketing."

A Machine Tool User's Tribute to the Machine Tool Builder

By WILLIAM WATSON
Vice-President in Charge of Manufacturing
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

THE publication of this number of MACHINERY, featuring such a large array of newly developed machine tools, provides the occasion for paying a well deserved tribute to the industry that furnishes other machine building and manufacturing industries with the equipment required to carry out their work.

IN purchasing the machine tools needed for the greatly diversified work of the Allis-Chalmers Mfg. Co.—from heavy and large machinery lines through agricultural equipment of varied character, and on down to small manufacturing work—our company has had dealings for years with a great many machine tool builders who have filled our demand for a large variety of tools and equipment. On this occasion, therefore, our company would like to go on record, not so much to suggest what we know that the machine tool industry will accomplish in the future, but rather to express our very highest regard for one of the most progressive industries in the United States.

DURING the past several years, there have been marked advances in the design of the machines and devices supplied by the machine tool industry. The engineers of that industry have proved themselves capable of designing machines and tools to meet the exacting requirements for economical production and the very highest quality of workmanship demanded in present-day manufacturing processes. Our company has relied to a great extent on the cooperation of the machine tool builder, and has profited by being able to approach him and his engineers, asking them to recommend or design machine tools to meet our requirements. During this contact, we have come to think very highly of the designers, tool engineers, and manufacturers in the machine tool field. We have come to consider them a very progressive body of men, and believe that, as an industry, the machine tool builders are about as far advanced, in keeping up with the times, as any other industrial group.

OUR company, therefore, has taken this opportunity to express our regard for the machine tool industry. We wish to say that our experience with that industry has been unusually satisfactory, our relations with it most harmonious, and that we look forward to a continuation of a most satisfactory cooperation with the machine tool industry in the future.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Friction-Drive Roll Feed

By M. J. GOLDSTEIN

A three-stage die designed by the writer for perforating and embossing strip stock for ornamental purposes was described in February MACHINERY, page 414. This die was provided with a simple, positive means for locating the stock at each stage, which facilitated feeding the strip material through the die by hand. When continuous operation of the press became necessary to meet production requirements, it was decided to employ a power feed. As a suitable automatic feed was not available, the writer built the one shown in Figs. 1 and 2. This automatic feeding arrangement has proved to be very satisfactory.

The feeding mechanism consists essentially of a pair of adjustable tension feed-rolls driven from an overhead shaft through a friction disk arrangement. This drive permits the rotation of the feed-rolls to be stopped momentarily while the stock is held stationary by the stop in the die for the piercing and embossing operations. An ordinary roll-feed base casting is used for the lower member of the feed, an additional casting being used to hold the upper drive-shaft. The rolls are 1 1/2 inches in diameter by 2 3/4 inches long. The gears keyed to the roll shafts have a pitch diameter of 1 1/2 inches and a 3/8-inch face. The method of applying spring pressure to the upper rolls is the same as that used for ordinary roll feeds.

The construction of the lower roll shaft is shown in Fig. 3, *A* being part of the bottom roll, *B* one of the bearing boxes, and *C* a flange fastened by a set-screw to the shaft, which is integral with the roll. The leather washer *D* is located in a recess in pulley *E*. The pulley has a bronze bushing which receives lubricant through an oil-hole drilled in the hub. Washers are assembled on each side of the spring *F*, as shown. The friction driving torque exerted on flange *C* by the leather disk *D* can be adjusted to suit requirements by means of the nut *G*.

The feed is driven by a 5/16-inch round belt from a grooved pulley mounted on the crankshaft of the press. The round belt drives the pulley on one end of the upper drive-shaft of the feed. The lower shaft, in turn, is driven by a belt from a pulley on the opposite end of the upper driving shaft. When the feed is in operation, the sheet metal is fed by hand through the die until the end is gripped by

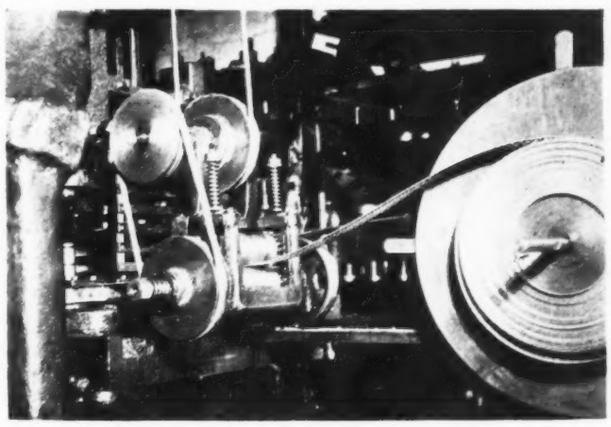


Fig. 1. Power-operated Roll Feed Applied to Three-stage Perforating and Embossing Die

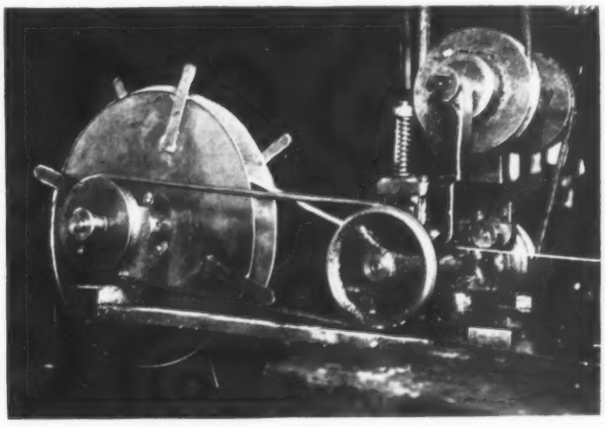


Fig. 2. Pick-up Reel on which Perforated and Embossed Strip Material is Wound

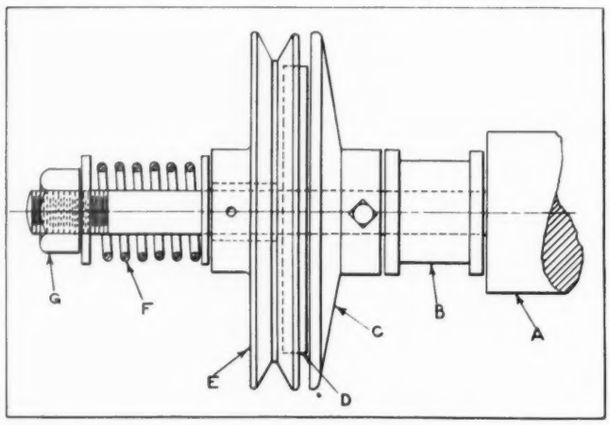


Fig. 3. Adjustable Friction Drive Mechanism of Lower Roll of Feed Shown in Fig. 1

the feed-rolls. The feeding of the stock is then taken care of automatically by the feed-rolls. The finished work is wound on the pick-up reel, which is driven by the grooved wheel on the lower feed-roll shaft.

The feed described has operated continuously eight hours a day for six months, making between 40,000 and 45,000 movements of the metal per day. Since putting this feed to work, the writer has built three additional feeds of similar design for use with dies that were formerly operated by hand and were equipped with finger type stops. These feeds have also given satisfactory service, the only requirement being that the feed belts be kept at the proper tension.

An interesting feature of the feed described is that it can be used with dies having finger-stops without changing the dies. The friction feed simply duplicates the work performed by the press operator; that is, it simply pulls the metal up to the stop, the stop operating exactly the same as when the stock is fed by hand.

Mechanism for Obtaining Uniform Adjustment of Guide Rollers

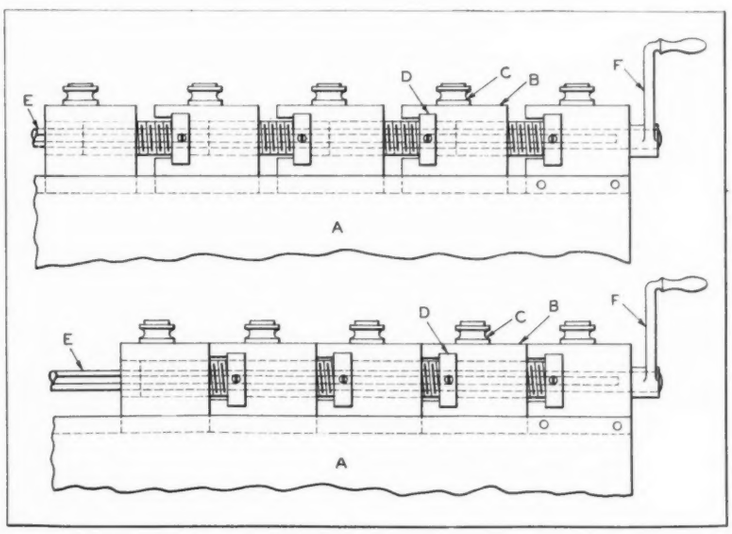
By L. KASPER

A number of strands of wire are fed into a machine for producing a woven wire product by passing the wires over grooved rollers. The rollers are spaced to meet certain specifications. At times, it is necessary to change the positions of the rollers in order to increase the "spread" of the wires. The adjustment must be accomplished while the machine is in operation, and the spacing between the wires must be uniform throughout the total spread. The two views in the illustration show the design of a guide mechanism that fulfills these requirements. When applied to the machine, the mechanism is located in a vertical position instead of in the horizontal position shown in the illustration.

A stationary part *A* of the machine has a dovetail groove in it to receive a series of blocks *B*, several of which are shown. These blocks are free to slide in part *A*, with the exception of the block at the extreme right-hand end, which is pinned in position. Each of the blocks *B* has a roller *C* which supports a strand of wire, and all the blocks carry an externally threaded bushing *D*, the head flange of which fits into a recess in the adjacent block *B*. Shaft *E* passes through the assembly of blocks and bushings, and is splined, so that any rotative motion given it through the crank-handle *F* is transmitted to bushing *D* through a key in the bore of each bushing. The screws that fasten the keys in the bores of bushings *D* are shown in the head flanges of the bushings.

The lower view in the illustration shows the mechanism with the rollers set in a position of minimum spread. It will be noted that each block *B* is in contact with the succeeding block. As shaft *E* is rotated by handle *F*, the bushings *D* are rotated with it, causing each block *B* to be moved away from its adjacent block by an amount equal to the lead of the thread on bushing *D* multiplied by the number of rotations given shaft *E*.

The upper view shows the mechanism as it appears after handle *F* has been given two turns. As



Mechanism for Obtaining Uniform Adjustment of Spacing between Rollers C

each of the bushings *D* is rotated, it withdraws from the block into which it is threaded, causing that block and all those above it to be raised the same amount. The increase in the spread between the two outside rollers represents the accumulative effect of the axial movement of bushings *D;* and as each of these bushings is rotated the same amount, the increase in the center distance between any two rollers is the same. Therefore, they are equally spaced over the total spread.

Tool Engineers to Hold Semi-Annual Meeting in Cleveland

THE American Society of Tool Engineers will hold its semi-annual meeting in Cleveland, Ohio, October 6 and 7, regardless of the fact that the Machine Tool Show has been postponed. Stanley R. Thomas, chief engineer of the Bantam Bearings Corporation, South Bend, Ind., will present a paper on "Application and Use of Anti-Friction Bearings as Applied to Machine Tools." Eugene Bouton, supervisor of time study, J. I. Case Tractor Works, Racine, Wis., will read a paper on "Application and Use of Plain Bearings as Applied to Machine Tools." Karl L. Hermann, of South Bend, Ind., will deal with the subject "Bearings—Their Use and Misuse."

At the semi-annual dinner and meeting to be held Friday, October 6, at which James R. Weaver, president of the Society will preside, the second report of the Fact-Finding Committee on "Effect of the Development of the Machine on Employment and Our Standard of Living" will be presented by John R. Younger, professor of the department of industrial engineering at the Ohio State University, who is chairman of the committee. An address on "The Economic and Political Effect on the Development of the Machine" will be presented by the Honorable Hamilton Fish, member of the United States Congress. Several plant visits will be arranged during the meeting.

Semi-Annual Meeting of Gear Manufacturers

THE semi-annual meeting of the American Gear Manufacturers Association (with headquarters at 602 Shields Bldg., Wilkinsburg, Pa.) will be held at Whitcomb Sulphur Springs, St. Joseph, Mich., October 16 to 18. Among the papers to be presented before the meeting are the following: "Inspection and Inspection Tolerances," by Granger Davenport, Gould & Eberhardt, Newark, N. J.; "Trends in Nickel Steel and Cast Iron Materials," by C. M. Schwitter, International Nickel Co., New York City; "Cost Determination is Not a Mystery," by Paul Christensen, Cincinnati Gear Co., Cincinnati, Ohio; "Gear Grinding," by John Dixon, Pratt & Whitney Co., Hartford, Conn.; "The Gear Manufacturing Industry," by U. Seth Eberhardt, Newark Gear Cutting Machine Co., Newark, N. J.; "Noise," by Professor F. A. Firestone, University of Michigan, Ann Arbor, Mich. A paper on Superfinishing will be presented by an engineer of the Chrysler Corporation, Detroit, Mich. The semi-annual dinner of the Association will be addressed by S. Wells Utley, president of the Detroit Steel Casting Co., Detroit, Mich., his subject being "Industry's Contribution to Civilization."

The subject of standardization will, as is customary at the meetings of the Association, be given a great deal of attention. Reports of several of the standardization committees will be presented, and some important phases of the subject will be discussed.

* * *

Ball-Bearing Installation Pays for Itself in One Month

Some time ago, the superintendent of a well-known Erie, Pa., plant stated that it was necessary to rebabbitt the plain bearings of a high-speed double-wheel grinding head every month. In addition, the lubricant bills ran high, since the bearings had to be oiled every thirty minutes. It was therefore decided to change over to ball bearings, use being made of Fafnir double ball-bearing pillow blocks. The cost of the change-over was about $50.

The use of ball bearings has greatly reduced the maintenance costs, and since the pillow blocks require only a small amount of grease every three months, instead of oiling every thirty minutes, the actual saving reported for one month was $51, not including the increased production, due to the fact that there is not any "down time" now.

The "Ekko" Process for Making Iron Dies

A New Method Developed by the United States Rubber Co. for Making Molds and Dies by an Unusual Development Known as the Electroforming Process

THE so-called "Ekko" process is a new method of making molds and dies which has grown out of the research conducted by the United States Rubber Co. with the aim of developing a method of making less expensive tire molds. During the course of this research, it became obvious that the new method offered advantages in making molds and dies for almost all industries. The molds and dies made by the Ekko process are so much cheaper than conventional dies that it becomes possible to produce articles where the tool cost might otherwise be prohibitive.

The new process produces the molds and dies by what has been termed "electroforming" of iron against a pattern that it is desired to reproduce. Electroforming is simply a type of electroplating, except that deposits up to 1/2 inch thick can be made instead of 0.001 or 0.002 inch as in the usual electroplating processes. Electroplating is mainly used for decorative purposes or to provide corrosion resistance, while electroforming is used to build up an appreciable mass of metal.

When the heavy electroformed deposits of iron are separated from the underlying pattern, a cavity or die is obtained in which are reproduced the shape and surface finish of the pattern in every detail. This cavity or die, when properly "backed up" or mounted, can be used to mold or stamp objects of the exact shape of the original pattern. The name of the process—Ekko—is simply the phonetic spelling of "echo," and was chosen to suggest the duplicating nature of the process.

Considering, first, the use of the process in making tire molds, it may be mentioned that a certain mold made by the usual process of engraving, where the tread design and cavity are cut out of a steel forging by engraving machines, requires at least 165 man-hours of labor to produce. Such a mold weighs about 600 pounds.

When one such mold has been produced by engraving, it can now be reproduced as many times as desired by electroforming. The engraved mold is used to mold the pattern, which is later covered with iron by electrodeposition. In the case of tire patterns, the pattern on which the iron is deposited is made of rubber. The pattern is rendered conductive by dusting it with powdered graphite and polishing it vigorously with a light brush. The polishing operation adds to the finish obtained on the electroformed cavity. Patterns on which the iron is deposited may be of wood, glass, or plastics, provided the surface is made conductive to the current, as explained. Metal patterns are also satisfactory, with the exception of those made from zinc or aluminum, which are attacked by the plating bath.

The iron deposited by the process is 99.98 per cent pure, and practically free from porosity. It is about 50 per cent harder than cold-rolled steel; it has a scleroscope reading of 37, and a Brinell

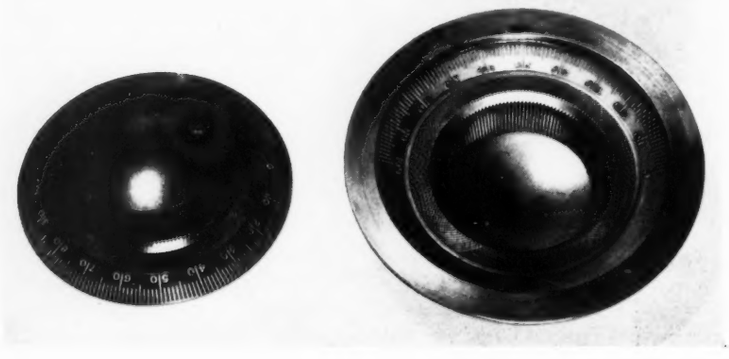


Fig. 1. A Radio Dial and a Mold Made by the Electroforming Process

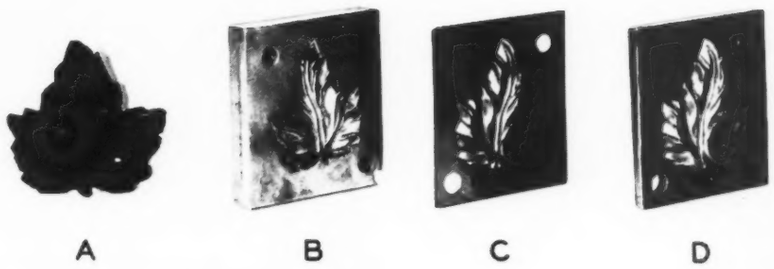


Fig. 2. A Die B and a Force D Made by the Electroforming Process from a Plastic Pattern

reading of 240. The deposited metal can be softened to the normal value for pure iron by annealing. It can also be hardened by carburizing, so that it will scratch glass. Electrolytic iron has a heat conductivity nearly twice that of cast iron or steel. This is of especial advantage in molding operations, where a high rate of heat transfer is desirable.

Fig. 1 shows a Bakelite radio dial which is used as a pattern to electroform the die-cavity at the right. The metal in this die-cavity is approximately 1/4 inch thick, and can be mounted for use as a die by machining the back to the required shape and inserting the electroformed cavity into a steel block hollowed out to receive it. The other half of the mold would be prepared and mounted in a similar manner. The dial scale and numbers are raised in the mold, a condition that is difficult and costly to obtain by engraving, as all the metal surrounding each scale division or number must be cut away. By the electroforming process, raised letters are produced as easily as depressed ones.

Fig. 2 shows a case where the process is used in making dies or "forces" for ornamental objects. Here a plastic brooch *A* was used as a pattern to electroform the cavity shown at *B*. A punch or force to match this die was then made, so that the brooch shape could be stamped in metal 0.015 inch thick. To do this, the cavity *B* was returned to the plating tank and a 0.015-inch thickness of iron *C* was plated. The new surface created was then treated for non-adherence and the force shown at *D* was plated, obtaining a sort of "sandwich" of the three parts—*B*, *C*, and *D*. The illustration shows these sections after they have been separated. The die *B* and the force *D* now have the proper clearance to stamp metal 0.015 inch thick, and are ready for use.

Fig. 3 shows a die and force electroformed directly from a hand-made candy dish. Dishes such as that used for the pattern for these dies owe much of their value to the fact that they are hand-made and contain small imperfections and tool marks left by the craftsman. The electroformed dies made from such patterns contain all the marks of the hand-made articles and can therefore produce, in simple stamping operations, exact duplicates of dishes made by hand. For stamping soft metal dishes, these dies can be mounted in a satisfactory manner by casting a zinc alloy to the back, so that they can be applied to a press like regular die-blocks.

These few examples give a general idea of the application of the process in some of the metal-working industries. The uses of the process are extremely broad and apply to a great many other fields. The United States Rubber Co., 6600 E. Jefferson Ave., Detroit, Mich., is in a position to make dies and molds by this process for other manufacturers, to meet any requirements for which the process is suitable.

Fig. 3. Dies for a Candy Dish Made by the Electroforming Process

NEW TRADE LITERATURE

Motors and Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-1326D, on totally enclosed, fan-cooled induction motors; 2997A, air circuit-breakers for resistance welding machines; 3235, percentage differential relays for alternating-current rotating machines; 3236, percentage differential relays for transformer protection; 3237, pilot-wire relays; 2973 Formex magnet wire. 1

Steel

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. General data book, 144 pages, containing metallurgical definitions; hardness equivalent tables; weight, dimension, and specific gravity tables; manufacturing tolerances for different types of steel; and standard specifications for bars, tubes, plates, etc. 2

Ball Bearings

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. A 200-page machine tool handbook giving descriptions, dimensions, capacity ratings, and mounting data for twenty types of ball bearings used in machine tools, including seven types designed for precision machines. 3

All-Steel Shears

CINCINNATI SHAPER CO., Cincinnati, Ohio. Twenty-eight-page catalogue illustrating and describing the complete line of Cincinnati all-steel shears, giving details of construction and listing a wide variety of optional equipment, gages, electric clutch control, etc. 4

Ground Thread Tools

JOHN BATH & CO., INC., Worcester, Mass. Catalogue 14, entitled "Ground Thread Handbook," covering taps, chasers, thread gages, and rolling dies—a strongly bound handbook of 193 pages, including ground threading tools of all types. 5

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 160 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY

Ball Bearings for Machine Tools

S K F INDUSTRIES, INC., Front St. and Erie Ave., Philadelphia, Pa. Catalogue entitled "S K F Machine Tool Spindle Bearings," showing twenty-six designs of machine tool spindle mountings, together with dimensional data. 6

Steel

CRUCIBLE STEEL CO. OF AMERICA, Chrysler Bldg., 405 Lexington Ave., New York City. Copy of the company's house organ, *Crucible News*, describing specialty steel products produced at the company's Atha Works, Harrison, N. J. 7

Milling Machines

U. S. TOOL COMPANY, INC., Ampere, East Orange, N. J. Bulletin 36, covering the complete line of the company's Multi-Millers for high-speed automatic production milling, as well as production grinding operations. 8

Silent Chain Drives

WHITNEY CHAIN & MFG. CO., Hartford, Conn. Catalogue V-135, 64 pages, 8 1/2 by 11 inches, containing engineering data, dimensions, horsepower ratings, and sprocket data for the selection and design of silent chain drives. 9

Centrifugal Clutch

DAWES EQUIPMENT, INC., 2280 Penobscot Bldg., Detroit, Mich. Leaflet giving details of the construction and applications of the company's new automatic centrifugal clutch for all types of industrial power drives. 10

Interlocking Arch for Furnace Roofs

FRAZIER-SIMPLEX, INC., Washington, Pa. Catalogue on an interlocking suspended arch, nose construction, and supported wall for heat-treating furnaces and similar installations. 11

Drafting Machines and Drawing-Boards

EMMERT MFG. CO., Waynesboro, Pa. Catalogue covering vertical or vertically inclined drafting machines and adjustable drawing-boards, including a new stainless-steel drafting machine. 12

Welding Rod

AMERICAN MANGANESE STEEL DIVISION OF THE AMERICAN BRAKE SHOE & FOUNDRY CO., Chicago Heights, Ill. Bulletin W-14, on "Dieweld," a new welding rod for reconditioning forging dies and all types of similar tools. 13

Universal Joints

MECHANICS UNIVERSAL JOINT DIVISION, BORG-WARNER CORPORATION, Rockford, Ill. Catalogue CA-1939, on roller-bearing universal joints, giving complete description and dimensions of different types. 14

Variable-Speed Transmission

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B-6013 entitled "Vari-Pitch Speed Changer—

Keying Production to Profits." The bulletin shows scores of installations and gives engineering data. 15

Surface Grinders

HILL CLUTCH MACHINE & FOUNDRY CO., 6600 Breakwater Ave., Cleveland, Ohio. Bulletin H-V-1, on heavy-duty open-side hydraulic surface grinders with built-in spindle motor. 16

Stainless Steel

CRUCIBLE STEEL CO. OF AMERICA, Chrysler Bldg., 405 Lexington Ave., New York City. Sixteen-page stock list SS100, giving sizes of Rezistal stainless-steel sheets, bars, and welding rods carried in stock. 17

Machine Tools

W. F. & JOHN BARNES CO., Rockford, Ill. Booklet entitled "Since 1872—A Service to Industry," illustrating and briefly describing the company's lines of high-production machine tools. 18

Speed Reducers

W. A. JONES FOUNDRY & MACHINE CO., 4409 Roosevelt Road, Chicago, Ill. Bulletin covering worm-helical speed reducers in fifteen ratios, ranging from approximately 40:1 to 250:1. 19

Carboloy Tools

CARBOLOY COMPANY, INC., East Eight Mile Road, near Van Dyke, Detroit, Mich. Bulletin GT-116 entitled, "How to Torch Braze Carboloy Tools," giving detailed information. 20

High-Speed Cutting Metal

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Chart giving the correct grade of Kennametal for machining twenty-one types of materials, together with recommended cutting speeds. 21

Electric Welding Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-3042A, on automatic arc-welding equipment; 3081B, low-current arc welders; 3058A, ignitron contactors for spot and projection welding. 22

Electric Welding

LINCOLN ELECTRIC CO., 12818 Coit Road, Cleveland, Ohio. Publication entitled "Pictorial of Welding Progress"—a photographic review of work done by Lincoln electric welders. 23

Wire Rope

HAZARD WIRE ROPE DIVISION OF THE AMERICAN CHAIN & CABLE CO., INC., Wilkes Barre, Pa. Catalogue 20, on wire rope—virtually a pocket-size handbook on the subject. 24

Line Starters

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Descriptive Data 11-200, on De-ion nonreversing line starters for squirrel-cage and wound-rotor motors. 25

Welding Equipment

HARNISCHFEGER CORPORATION, Milwaukee, Wis. Bulletin W-26, entitled "The 200-Ampere Multi-Arc Welding Service," describing a new welder recently introduced. 26

Ball Bearings

BEARINGS CO. OF AMERICA, 513 Harrisburg Ave., Lancaster, Pa. Practical handbook for engineers and draftsmen, containing engineering data on ball bearings. 27

Variable-Speed Transmission

LINK-BELT CO., 2045 W. Hunting Park Ave., Philadelphia, Pa. Book 1574, illustrating and describing P.I.V. gear variable-speed transmission units. 28

High-Strength Cast Iron

MEEHANITE RESEARCH INSTITUTE OF AMERICA, INC., 311 Ross St., Pittsburgh, Pa. Bulletin 9, entitled "Meehanite—The Metal for Machine Tool Castings." 29

Stop-Nuts

ELASTIC STOP NUT CORPORATION, 1015 Newark Ave., Elizabeth, N. J. Fifty-six-page catalogue and data book giving full information on elastic stop-nuts. 30

Portable Tools

ROTOR TOOL CO., 17325 Euclid Ave., Cleveland, Ohio. Booklet entitled "A True Gold Mine," emphasizing advantages of modern portable tools. 31

Welding Timer

ELECTRIC CONTROLLER & MFG. CO., Cleveland, Ohio. Folder 1201, entitled "The New EC&M Neotron Weld Timer for Spot, Butt and Projection Welding." 32

Corrosion-Resistant Alloy

BURGESS-PARR CO., Freeport, Ill. Bulletin 103, descriptive of the physical properties and applications of the corrosion-resistant alloy "Illium." 33

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Folder illustrating and describing the 200-ampere "Shield-Arc Junior" belted or direct-driven Lincoln welder. 34

Contour-Measuring Projector

BAUSCH & LOMB OPTICAL CO., 619 St. Paul St., Rochester, N. Y. Catalogue D-27, covering the company's contour-measuring projector for precision measurements and inspection. 35

Chains and Sprockets

WEBSTER MFG., INC., Tiffin, Ohio. Catalogue 60-A, entitled "Webster Chain Sprockets"; 139 pages, 7 1/2 by 11 inches; giving very complete data. 36

Ball-Bearing Lineshaft Boxes

FAFNIR BEARING CO., New Britain, Conn. Folder describing the company's entire line of ball-bearing lineshaft boxes. 37

Grinding Machines

NORTON CO., Worcester, Mass. Bulletin entitled "Kerosene Lubrication Now Used for Norton Wheel Spindles." 38

Chamfering and Burring Machines

CIMATOOL CO., Dayton, Ohio. Folder covering gear chamfering and burring machines. 39

Ball Bearings

M-R-C BEARINGS SERVICE CO., Jamestown, N. Y. Book 4, entitled "How to Service Ball Bearings in Automotive Equipment." 40

Pulleys

ROCKWOOD MFG. CO., Indianapolis, Ind. Booklet No. 860, covering all types of Rockwood paper pulleys for industrial use. 41

Materials-Handling Devices

BARRETT-CRAVENS CO., 3255 W. 30th St., Chicago, Ill. Junior cata-

logue 639, covering 176 different materials-handling devices. 42

Hydraulic Presses

A. B. FARQUHAR CO., LTD., York, Pa. Catalogue illustrating and describing the company's complete line of hydraulic production presses. 43

Hand Tachometers

HERMAN H. STICHT & CO., 27 Park Place, New York City. Bulletin 720, listing new ranges of Standco hand tachometers of governor type. 44

Socket-Head Screws

STANDARD PRESSED STEEL CO., Jenkintown, Pa. Comprehensive catalogue entitled "'Unbrako' Screws and Miscellaneous Screw Data." 45

Electric Equipment

DEAN W. DAVIS & CO., INC., 545 W. Fulton St., Chicago, Ill. Catalogue 10, covering solenoids, coils, and transformers. 46

Spring Winders

JOHN BLANER CO., P. O. Box 163, Sharon, Pa. Circular illustrating and describing universal hand spring winders. 47

Motor Control

ELECTRIC CONTROLLER & MFG. CO., Cleveland, Ohio. Booklet 88, entitled "Custom Built Automatic Motor Control." 48

Tracing Paper

KEUFFEL & ESSER CO., Hoboken, N. J. Folder covering Albanene, the stabilized tracing paper. 49

Pivoted Motor Drives

ROCKWOOD MFG. CO., Indianapolis, Ind. Booklet 861, on Rockwood pivoted motor drives. 50

Factory Buildings

AUSTIN CO., Cleveland, Ohio. Booklet entitled "Your New Plant—Multistory or Single Story—Which?" 51

* * *

Industry Buys Equipment

The Warner & Swasey Co., Cleveland, Ohio, well-known builder of machine tools, has, since September 1, purchased over $200,000 worth of new equipment and machinery. According to Charles J. Stilwell, president of the company, this additional equipment, consisting chiefly of machine tools, is needed to speed up the company's volume of turret lathe production to meet the sudden increased demand that has come since war was declared in Europe. By far, the largest increases in orders have come from domestic manufacturers of peace-time products.

According to Mr. Stilwell, while buying for foreign and domestic defense programs has increased materially, a much sharper up-turn of orders has come from the electrical equipment, plumbing supply, printing machinery, oil-field equipment, hardware, heating, and other industries. The company is working three shifts, and has orders on hand to work to capacity for several months ahead.

The Republic Steel Corporation, Cleveland, Ohio, reports appropriations totaling more than $3,000,000 for expansion and improvement of plant facilities, and replacement of old equipment at the company's plants at Youngstown, Warren, Niles, Canton, and Cleveland, Ohio, Buffalo, N. Y., and Birmingham, Ala.

* * *

Southwark-Tate-Emery Testing Machine at the World's Fair

In the article published in August MACHINERY which outlined some of the interesting metal-working operations in the Ford Exhibit at the New York World's Fair, it was stated that a Tinius Olsen tensile testing machine was included in the testing section. Instead, the tensile testing machine in this exhibit is a Southwark-Tate-Emery built by the Baldwin-Southwark Corporation, Philadelphia, Pa.

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The Flame-Hardening of Gear Teeth

The Recently Developed Method of Simultaneously Hardening Both Faces of Gear Teeth Has Many Advantages

UNTIL a short time ago it was the practice to flame-harden the opposite sides of each gear tooth separately when the flame-hardening method was applied. Recently, so-called "straddle type" torch-heads have been developed, by means of which both sides of the gear tooth are heated and quenched simultaneously. Foremost among the advantages of the new flame-hardening method, says *Oxy-Acetylene Tips*, is that an entire gear can be hardened in one-half the time formerly required. In addition to doubling the speed of operation on all gear work, whether the teeth are large or small, this method has two other advantages over that of hardening one side of a tooth at a time, particularly when small, closely spaced teeth are being treated.

Advantages of Straddle Type Heads

The first advantage is that tempering or softening of the first side of the tooth treated by the single-head method is eliminated. Under the older method, heat applied to the second side of the tooth had the tendency to soften the side already treated. In contrast, the simultaneous application by the straddle method leaves both sides of the tooth hardened uniformly.

The second advantage is that distortion caused by the single-side treatment is avoided. Because the straddle method provides for heat and quench striking both sides of the tooth simultaneously, the tendency for small teeth to distort is overcome.

The straddle type heads for performing the hardening operation are designed for work on 1, 2, and 3 diametral pitch teeth, although they are applicable to intermediate tooth sizes as well. They are used in pairs, a right-hand and a left-hand head making up a set. In addition to gear work, the heads can be used for other hardening applications, such as keyways, splines, piston-ring grooves, and wobbler ends.

The small size of straddle type heads allows exact positioning in limited spaces. This permits more accurate control in directing the flame toward the portion of the tooth surface to be treated. Good workmanship, also, is more easily attainable. An exact relationship between the heating and quenching is constantly maintained, since the flame and water orifices are incorporated as a unit in each head. In addition, the arrangement of the heating orifices compensates for varying thickness of the tooth and assures a symmetrical case. The closer spacing of the orifices at the bottom of the head gives the greatest concentration of heat where the surface is backed by the greatest mass of metal.

Hardening Procedure

Right- and left-hand heads of correct size for the gear to be hardened should be connected to suitable blowpipes held securely in a traversing device. Oxy-acetylene cutting machines are well adapted for this purpose, although other traversing devices, such as the tool carriage of planers or shapers, will also answer the purpose. The gases should be controlled by a quick shut-off valve.

After the pressures have been properly adjusted and the head has been lighted, the machine should be moved along the track until the flames are just over the tooth edge, but with the water streams not touching the tooth. This position should be held until the tooth face reaches the hardening temperature. The machine should then immediately be put in gear. When the flames are within 3/16 inch of the leaving end of the tooth, the oxygen and acetylene should be shut off and the machine set at maximum speed. Subsequent teeth should be treated in a similar manner until all the teeth have been hardened.

To insure equal hardness and contour on each side of the tooth, the distance from the tooth faces to the torch head faces must be equal, and the flame intensities and gas ratios the same. The leading flames of the heads must arrive at the entering end of the gear tooth at the same time.

Care should be taken to avoid overheating the tooth at the beginning of the operation. The time required for the water quench to strike the tooth edge after the machine has been put in motion may be sufficient to overheat the tooth if the starting period is too long. Too great an initial preheat tends to deepen the case across the entire tooth.

The quench-water pressure is important, especially on the smaller tooth sizes. Too much pressure will interfere with the flames, and too little may not produce sufficient hardness of the gear-tooth surface.

* * *

Machinery Exports Continue to Rise

The United States exports of industrial machinery during the month of July, the last month for which complete statistics are available, were valued at over $24,550,000, a gain of 17 per cent over the corresponding month in 1938, as reported by the Machinery Division of the Department of Commerce.

The increase was especially marked in power-driven metal-working machinery, the exports of which were 44 per cent above a year ago. The July exports of metal-working machinery were valued at $9,359,000 as compared with $6,490,000 a year ago. In these exports, engine lathes were valued at $555,000; turret lathes, $700,000; vertical boring mills and chucking machines, $640,000; thread-cutting and automatic screw machines, $530,000; milling machines, $1,850,000; vertical drilling machines, $107,000; planers and shapers, $838,000; surface grinders, $284,000; and other grinding machines, $1,630,000.

It is also of interest to note that there was a tremendous increase in the exports of construction and conveying machinery the total shipments of which were valued at nearly $3,000,000, an increase of 67 per cent over July, 1938.

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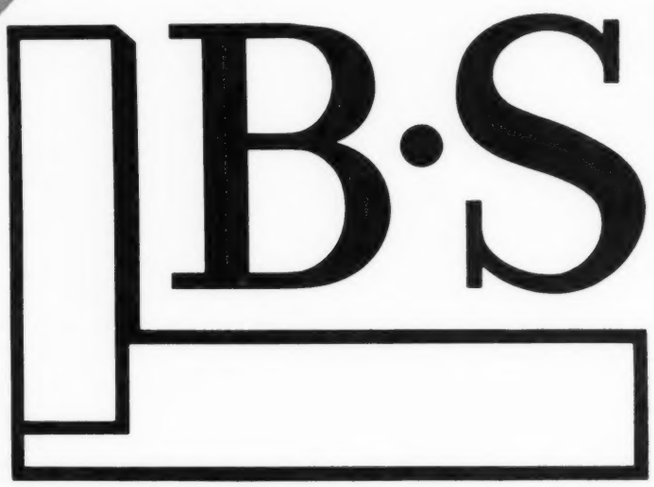

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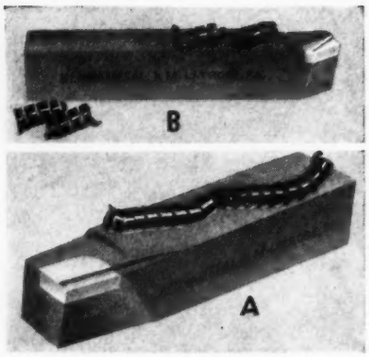
SHARPE

New Lathe Tools Provided with Chip-Breakers for High-Speed Turning

Two new forms of Kennametal single-point turning, facing, and boring tools for machining steel either in the annealed, as forged, as cast, or in the heat-treated form in any hardness up to 550 Brinell, are shown in the accompanying illustration. These new tools have been designed by the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., to solve the problem of convenient chip disposal in cutting steel at high speeds.

The style No. 11 right-hand turning tool shown at *A* has a parallel chip-breaker groove or form, designated a chip curler. In the tool shown at *B*, the chip curler or groove is ground at an angle, usually 20 to 40 degrees from the side cutting edge, and is designated a chip-breaker form. This tool breaks the chips, even when the material is tough nickel steel, by deflecting them against the unturned shoulder.

These chip-breaker tools are particularly useful in turning shafts, steel rolls, or projectiles, or wherever large volumes of chips are produced by rapid turning operations. In regrinding these tools, it is preferable to employ a fixture and to use diamond-impregnated Bakelite wheels. The tools can be ground by hand, however, using special loose-bond silicon-carbide grinding wheels to maintain the chip-breaker form.



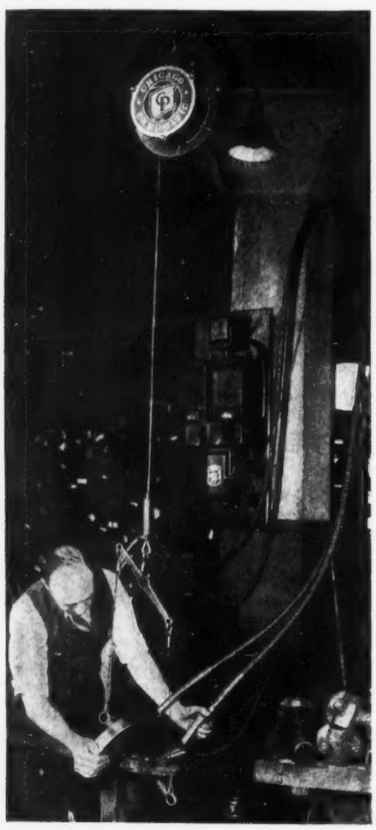
Kennametal Lathe Tools with Chip-breaker and Chip-curler Grooves

* * *

"Super Safety" Balancer

The "Super Safety" balancer here illustrated has been developed by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, for use in plants where portable tools or other objects weighing up to 200 pounds must be lifted, suspended, or balanced. This balancer is built in fifteen standard sizes, the capacity of the smallest size ranging from 5 to 10 pounds. The maximum capacity of the largest size is 200 pounds.

An automatic safety lock prevents the suspended tool or object from falling should the balancer spring break. A drum lock serves to hold the load at any point while changing the spring or cable. Over-winding of the cable in either direction is prevented by an automatic cable lock. The spring of any size balancer can be quickly adjusted for any load within its capacity.



"Super Safety" Balancer Made by the Chicago Pneumatic Tool Co.

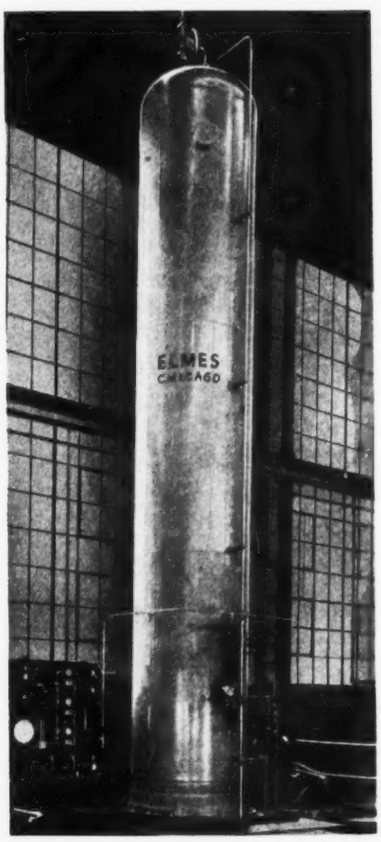
* * *

Hydraulic Accumulator with Air Ballast

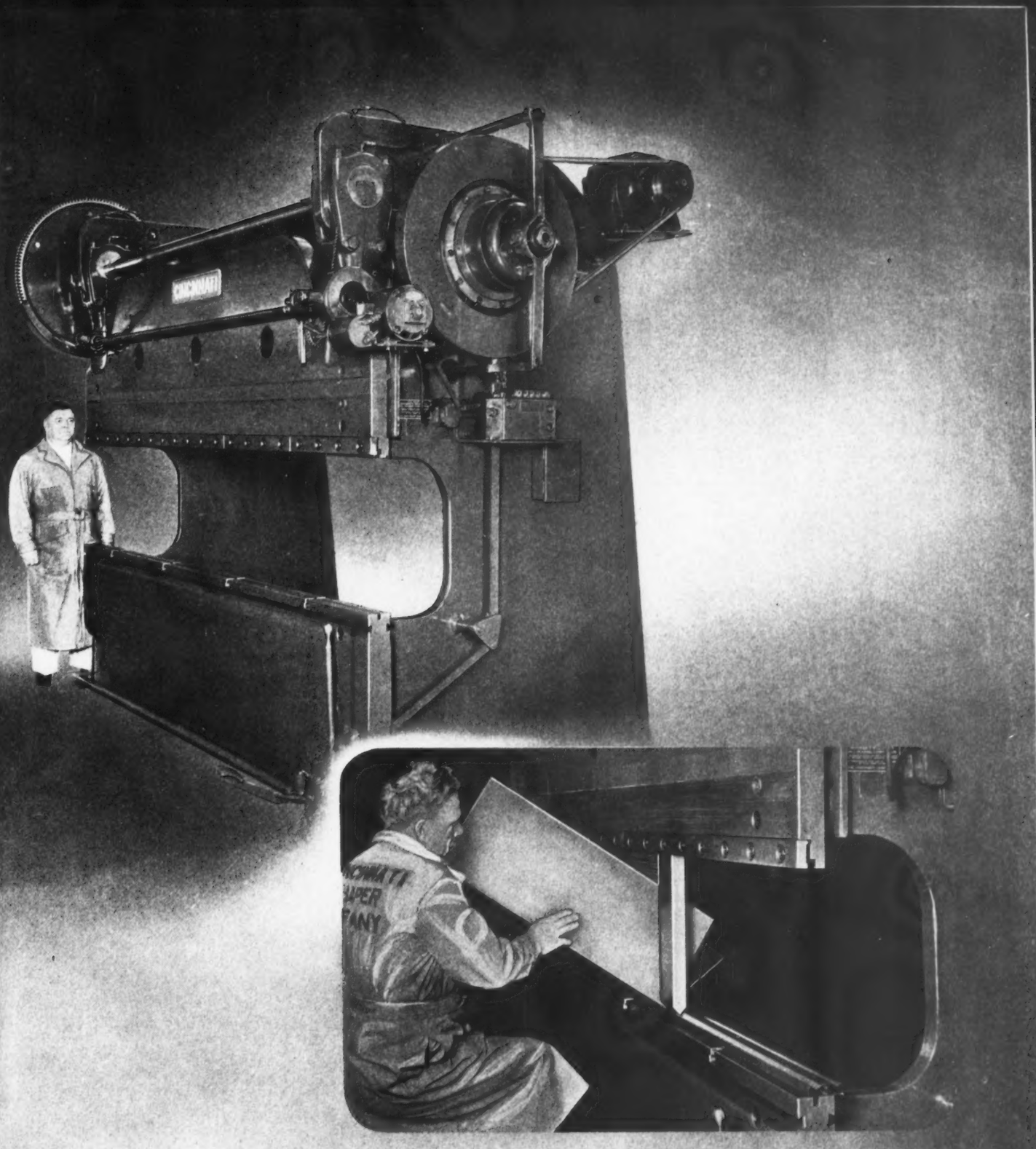
Recently plant operators, on the alert to obtain improved equipment, have been watching closely the development of air-ballasted accumulators for hydraulic systems like the one shown in the accompanying illustration. This air-ballasted pistonless type hydraulic accumulator has a capacity of 275 gallons at 2500 pounds working pressure, and is one of the latest developments of the Charles F. Elmes Engineering Works, Chicago, Ill.

One of the obvious advantages of these new air-ballasted accumulators is their light weight, which makes it unnecessary to provide pits and heavy foundations or ballast. This, of course, simplifies installation and reduces the amount of floor space required. With accumulators of this type, there are no line shocks to cause undue stresses on pipe lines, valves, molds, etc. Variations in pressure are also eliminated. Maintenance costs are reduced through the elimination of internal packing. Since there are no internal moving parts to get out of order, there is no necessity for exhausting the air and liquids for inspection or repairs.

The pressure vessels of the air-ballasted accumulator conform to all safety codes, and the controls are simple, automatic, and positive. All adjustments are made from a conveniently located control panel. High- and low-pressure units are available in any desired capacity.



Elmes Air-ballasted Hydraulic Accumulator



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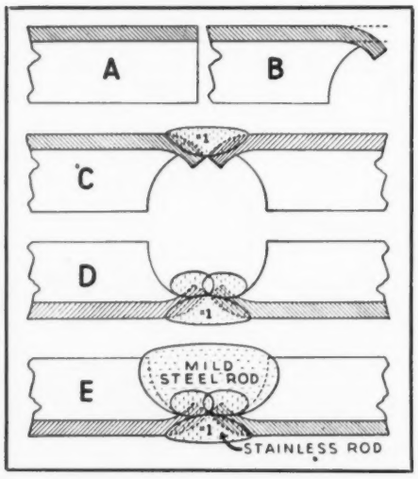

Method of Welding Stainless-clad Steel

New Method of Welding Stainless-Clad Steel

The Composite Steel Division of the Jessop Steel Co., Washington, Pa., has recently developed a new method of welding stainless-clad steel that eliminates the danger of reducing the corrosion resistance in the weld zone. In the past, some difficulty has been met with in welding stainless-clad steel, due to the admixture of mild steel with the stainless steel in the weld zone. This occurred even when stainless-steel rods were used.

The new method of welding stainless-clad steel makes it possible to retain the full corrosion resistance of the weld zone, even when a mild-steel rod is used for welding the backing.

Briefly, the method is as follows: The plate is scarfed and the cladding bent down at the place where the weld is to be made, as shown at *B* in the illustration. The first weld is made with a 1/8-inch diameter stainless-steel coated rod at the juncture of the two claddings *(C)*. The two plates are then turned over and a secondary weld of the cladding is made at the under side by using a 3/16-inch diameter stainless-steel coated rod *(D)*. Then a final weld is made, joining the mild-steel backing by a 1/4-inch diameter mild-steel coated rod, as shown at *E*, which represents the completed weld. The bead formed by the stainless rod is next ground flat with the cladding.

In all cases where stainless-steel rods are used, the rods should be richer in alloy than the cladding. The lowest possible amperage and the fastest possible welding time are recommended. The procedure makes possible great savings in the cost of welding rod, since mild steel welding rod may be used to weld the backing.

* * *

Multiple Rivet-Setter with Solenoid-Operated Movable Anvil

A multiple rivet-setter with a movable anvil that is actuated by a solenoid has recently been developed by the Chicago Rivet & Machine Co., 1810 S. 54th St., Chicago, Ill. The design of this setter permits a special indexing fixture to be used in the application of multiple setting to the line-assembling of small parts.

Pressure on the operating pedal causes the solenoid to actuate a toggle mechanism which raises the anvil into the clinching position. When the clinching is completed, the driver automatically rises and breaks the electrical contact with the solenoid. This causes the anvil to drop, so that the assembly fixture can be moved to the next indexing position. This unit is adaptable for clinching tubular rivets, as well as eyelets.

Multiple Rivet-setter Developed by the Chicago Rivet & Machine Co.

Eye Accidents are Costly to Workers and to Industry

A statistical report recently issued by the Industrial Commission of Wisconsin, as quoted by the American Optical Co., Southbridge, Mass., reveals that eye-injury cases settled in 1938 under the Wisconsin Workmen's Compensation Act totalled 725, at a cost of $426,376. This represented over 9 per cent of the total compensations paid for all injuries in the state during that year. Furthermore, the report shows that the average compensation for eye injuries was $588, whereas for other injuries, the average compensation was only $230. This indicates how serious eye injuries in industry are likely to be and how often these accidents happen. There are ample means available in the form of protective goggles to prevent such accidents; any work, in the performance of which there is likelihood of eye injury, calls for the use of such protective goggles.

* * *

Father Turns Job over to Son After Fifty Years with Firm

Putnam L. Pitcher, who recently retired from his position as special steam turbine inspector with the Allis-Chalmers Mfg. Co., Milwaukee, Wis., after fifty-one years of service, has no patience with the idea that engineering corporations cannot use men after they reach the age of forty. After having been with the Allis-Chalmers company for sixteen years, Mr. Pitcher, in 1904, assumed the duties that he has just relinquished. Upon his retirement, his son, who has been with the Allis-Chalmers company nearly twenty-five years, was appointed to the position made vacant by his father's retirement. Ever since 1904, when the Allis-Chalmers company started the manufacture of steam turbines, no turbine has ever been shipped from the company's works that did not have Mr. Pitcher's stamp of approval. It is unusual to record such long service with one company as that of Mr. Pitcher.

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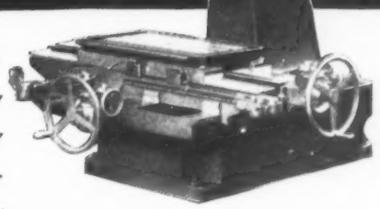

CATALOG ON REQUEST

THE CINCINNATI BICKFORD TOOL CO.

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Cleaning and Starting Electric Motors After an Extended Shut-Down

According to A. W. Ray, service manager of the Reliance Electric & Engineering Co., Cleveland, Ohio, if motors and generators have been idle for some time, they should be thoroughly inspected before starting, as dirt and dampness may have greatly affected the equipment. For testing the insulation between the windings and the ground, the "megger" test is simple and fairly accurate. The U. S. Navy Specifications require a reading of nearly one million ohms on 230-volt machines, though good new motors will easily show five to fifty million ohms. Should the megger readings show zero, check for a breakdown that will require repairs. If the motors show a reading of less than 500,000 ohms, plan on a general cleaning and drying. Clean thoroughly first, and then test again with the megger. If the readings are satisfactory, no special drying out will be necessary. However, if the readings are still low, it is likely that dampness causes the trouble.

For cleaning the windings, use gasoline or benzol, if the ventilation is good and there is no danger of explosion or fire. Otherwise, use carbon tetrachloride as a safe and efficient agent for removing oil, grease, and dirt. When dry, apply a coat of good insulating varnish, brushed or sprayed.

A baking oven with good ventilation is ideal for drying; but if not available, motors may be mounted on an insulated base, connected to the line, and run idle. While the motor or generator is mounted on the insulating base, be careful not to handle any of the metal parts. Shunt fields will normally dry out in this manner; and if the surrounding atmosphere is normal, the other windings will probably dry out considerably as well.

In the case of a generator, it is sometimes advisable to run with the main armature leads short-circuited through a suitable resistance and with the field circuit open. If this does not give enough current, the application of a small external voltage to the shunt field will usually be sufficient. It is also practicable to run motors as generators for drying armatures and series coils. In all cases, a six- to ten-hour run should be made, in order that all parts will be uniformly heated and dried out.

Commutator and brush rigging should be checked carefully. The commutator must be smooth and round. The mica should be undercut, or, at least, made flush with the commutator. Brushes should be free-acting, fitting the commutator perfectly, and having some leeway for wear.

The sleeve bearings should be checked for wear, and if this is excessive, the bearings should be renewed at once. This is very important in the case of induction motors. Draining and cleaning of oil wells, with the addition of new oil, is good insurance. As to ball bearings, particular attention should be given to the lubrication. Some greases have a tendency to separate and oxidize. Should this happen during a shut-down period, the grease may harden over the balls and raceways, so that the bearings fail to function.

Most ball- or roller-bearing motors and generators can be turned over freely by hand. If much effort is required, the inside of the bearing housings should be axamined. First flush out the old grease with gasoline, benzine, kerosene, or carbon tetrachloride, and then flush with warm lubricating oil. Next, try rotating the machine to see if it turns over and keeps running more easily. Repack the bearing about one-fourth to one-third full with an approved ball-bearing grease, but do not overfill it. Exposed ball bearings should be guarded carefully against dirt. The housings should be inspected to make sure that the original seals used to prevent entrance of dirt, etc., are in good shape.

While reference has been made specifically to armature and shunt fields, alternating-current stators and alternating-current wound rotors should be included. Low direct-current voltage applied to the stator is one method of producing heat for the drying out process; the use of low alternating current, with the rotor removed, is another method occasionally employed. Rotor windings and slip-rings should be given the same careful inspection as the parts of direct-current machines.

During the shut-down period, the equipment may have been robbed of parts to be used as "spares" on other equipment. Be sure to inspect carefully to determine that all the parts are in place.

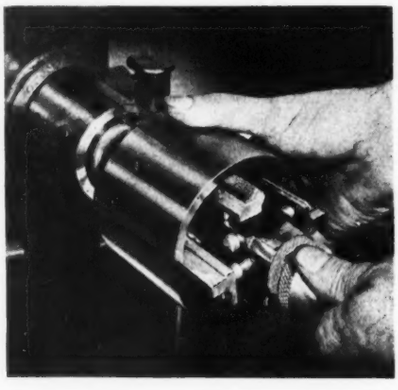
* * *

Contest for Instrument Makers and Users

The Scientific Apparatus Makers of America, 20 N. Wacker Drive, Chicago, Ill., have announced a contest, with a first prize of $200, and total prizes of $500, for reports or essays on the subjects "Instruments Save Money" and "Instrumentation Makes Jobs." The contest closes November 15. Further information can be obtained by addressing the Scientific Apparatus Makers of America at the address above.

* * *

A British firm has recently completed a Diesel locomotive to be used on the highest-altitude railway line in the world, near La Paz, Bolivia. This line reaches an altitude of 16,000 feet above sea level. On this railway line there is a six-mile climb with a gradient of 1 in 14. Up to the present, electric traction has been employed on this line.



A Mandrel Adapter which Increases the Size Range of the Bores that can be Honed on the Sunnen Precision Honing Machine from 2.4 to 7 Inches Diameter, Recently Brought out by the Sunnen Products Co., 7900 Manchester Ave., St. Louis, Mo.

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For precision grinding external threaded sections up to 6" outside diameter, having as much as 8" length of thread, on work up to 18" between centers. Style No 33.

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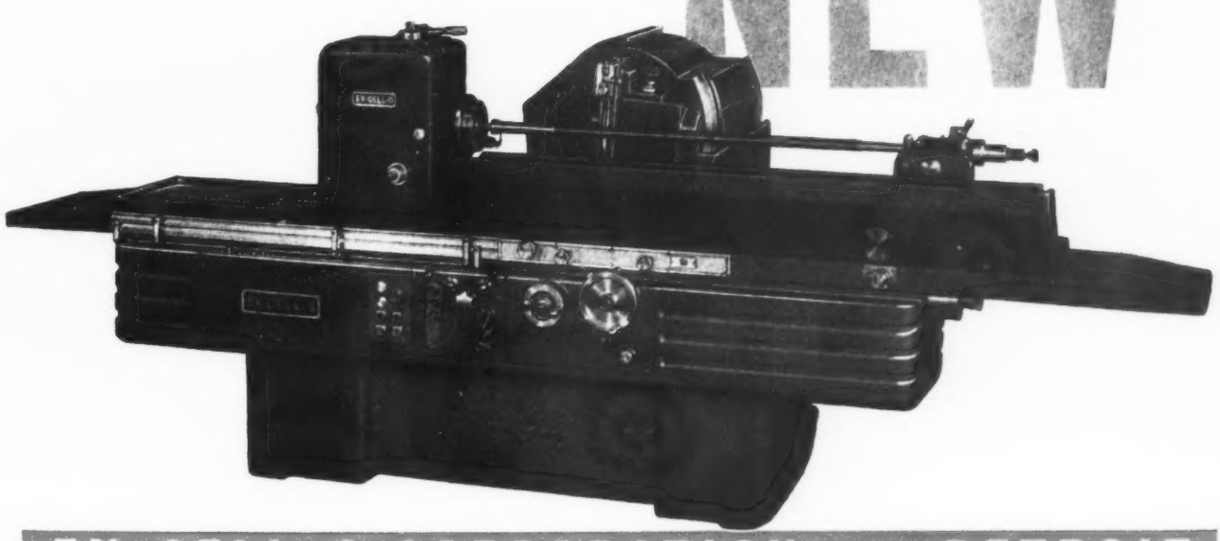
For precision grinding internal threads up to 9½" inside diameter, having as much as 4" length of thread, in work up to 10" outside diameter, 13" long overall. Style No. 39

For precision grinding external threaded sections up to 12" outside diameter, having as much as 50" length of thread, on work up to 115" between centers. Style No. 50. Send for catalog on Ex-Cell-O Precision Thread Grinders (seven styles).

NEW



EX-CELL-O CORPORATION - DETROIT

NEWS OF THE INDUSTRY

California

FRAY-MERSHON, INC., Glendale, Calif., announces that, effective September 1, the merchandising of All-Angle full-universal milling machines and All-Angle vises will be done by the Fray Machine & Tool Co., Glendale, Calif., which company has done all the manufacturing of these tools for some years.

Canada

CHARLES E. WEBSTER has been appointed general manager of the Timken Roller Bearing Co., Ltd., 55 Charles St., West, Toronto, Ontario, Canada. Mr. Webster, a Canadian by birth, has been associated with the Timken Canadian activities for twenty years.

R. B. Nichols, Newly Elected Secretary of the Bantam Bearings Corporation

Illinois

AMERICAN SOCIETY OF TOOL ENGINEERS, Chicago Chapter, will hold a meeting at the Midwest Athletic Club, October 2. John A. Macdonald, chief tool designer of the Caterpillar Tractor Co., Peoria, Ill., will be the principal speaker, his subject being "Behind the Scenes in Tool Design." The address will be accompanied by the first showing of a motion picture made at the Caterpillar plant.

MOLINE TOOL CO., Moline, Ill., has taken over the manufacture and sale of the high-production drilling, boring, and tapping machines heretofore manufactured by the ROCKFORD DRILLING MACHINE DIVISION of the BORG-WARNER CORPORATION, Rockford, Ill. The machines will be built in the Moline Tool Co.'s plant in Moline, together with the company's present lines of machines.

EARL D. CONANT, formerly vice-president of the Buda Co., Harvey, Ill., has opened offices at 346 W. 107th Place, Chicago, Ill., to act as manufacturers' agent for several lines of small tools and machine shop equipment in the Chicago area.

Indiana

R. B. NICHOLS has been elected secretary of the Bantam Bearings Corporation, South Bend, Ind., subsidiary of the Torrington Co., Torrington, Conn. He has been associated with the bearing business for the last fifteen years, most of the time with the Bantam corporation, having held the positions of superintendent and sales manager. In addition to his new duties, he will continue as sales manager.

MANLY E. LORD has been appointed manager of the Fort Wayne Works of the General Electric Co. to succeed NEIL CURRIE, JR., who will become assistant to the vice-president in charge of manufacturing. Mr. Currie went with the General Electric Co. in 1908 and has been manager of the Fort Wayne Works since 1936. Mr. Lord also became connected with the company in 1908 and has held a number of positions in the company's Schenectady Works.

New York and New Jersey

AMERICAN SOCIETY OF TOOL ENGINEERS, Elmira Chapter, Elmira, N. Y., met September 15 at the Hotel Langwell, Elmira, for the first meeting of the season. V. H. ERICKSON, research engineer of the Norton Co., Worcester, Mass., spoke on the subject "Refined Surface Finishes as Applied to Regrinding of Metal Cutting Tools." Two motion pictures in technicolor, "Norton Abrasives" and "Norton Abrasives at Work," were also presented.

UNIVERSAL GEAR CORPORATION, Indianapolis, Ind., announces the opening of a direct factory sales office in the Lincoln Building, 60 E. 42nd St., New York City. M. E. ROBBINS, assistant director of sales, is in charge of the eastern district office.

A. MILNE & CO., 745 Washington St., New York City, have been appointed "correspondents" in the United States for the English Steel Corporation, Ltd., Vickers Works, Sheffield, England.

STRIPPIT CORPORATION, maker of the Wales type adjustable punches and dies, has moved from 1559 Niagara St., Buffalo, N. Y., to new and larger quarters at 1200 Niagara St.

AMERICAN SOCIETY OF TOOL ENGINEERS, New York-New Jersey Chapter, of which Ben C. Brosheer, 330 W. 42nd St., New York City, is secretary, held its monthly meeting Tuesday evening, September 12, at the Hotel Robert Treat, Newark, N. J., at which time Ralph E. Flanders, president of the Jones & Lamson Machine Co., Springfield, Vt., spoke on the subject "The Tool Engineer's Place in Industry."

Ohio

RAY P. TARBELL has joined Una Welding, Inc., 1615 Collamer Ave., Cleveland, Ohio, as sales engineer, specializing in automatic welding applications. He was formerly connected with the Lincoln Electric Co. and the Babcock & Wilcox Co., and has also been associated with Robert E. Kinkead, consulting welding engineer.

DETROIT BALL BEARING CO., Detroit, Mich., announces that the DETROIT BALL BEARING CO. OF OHIO, with headquarters in Toledo, Ohio, has become successor to the OHIO BALL BEARING CO., of Toledo. G. E. BINKELMAN, formerly with the Timken Roller Bearing Co., will be manager of the Toledo company.

BURDETT OXYGEN CO., 3300 Lakeside Ave., Cleveland, Ohio, has been appointed sole distributor for the state of Ohio for the line of electric welders manufactured by the HAMPTON ELECTRIC TOOL CO., 700 Walnut St., Edgewood, Pittsburgh, Pa.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., announces that the company is now represented in the Cleveland territory by GOLDEN & MCCOY, 270 Rockefeller Bldg., Cleveland, Ohio.

Pennsylvania and Maryland

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa., is building an addition to the Aluminum Research Laboratories at New Kensington, Pa. A two-story addi-

tion is being made to the testing laboratory for the purpose of housing a new testing machine; a one-story extension is being made to the present shop building; and a three-story extension to the main building. The floor space will be increased by 15,000 square feet, bringing the total laboratory floor space to 71,000 square feet. The new testing machine to be installed will be capable of exerting a pressure of 3,000,000 pounds in compression; its capacity in tension is 1,000,000 pounds. It will be one of the largest machines of its kind.

W. H. SPENCER has been appointed manager of the foundry division of the Wilkening Mfg. Co., Philadelphia, Pa., manufacturer of Pedrick heat-shaped piston-rings. Mr. Spencer graduated from Vanderbilt University in 1926 with a degree in chemical engineering, and has since been with the American Cast Iron Pipe Co., Birmingham, Ala., and the Sealed Power Corporation, Muskegon, Mich. ROBERT E. HUNT has been appointed engineer in charge of research and product development of the Wilkening Mfg. Co. He is a graduate of the Michigan State College, class of 1933, and has since been with the Reo Motor Car Co.

DR. GLENN O. EBREY has been appointed to a fellowship in the Mellon Institute, Pittsburgh, Pa., instituted by the Fleming Mfg. Co., Providence, R. I., for the purpose of studying the design, construction, and operation of oil filters, with the aim of bringing about improvements in such equipment. Dr. Ebrey has been research chemist with the Sinclair Refining Co., East Chicago, Ind., and chief chemist with the Pennzoil Co., Oil City, Pa.

FRANCIS A. CALDEN, formerly with the E. W. Bliss Co. and the firm of Akerlund & Semmes, is now a member of the hydraulic press sales staff of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Mr. Calden has done designing, erecting, testing, and sales engineering work in the hydraulic press field throughout the United States and abroad. He is a graduate of the Massachusetts Institute of Technology.

Francis A. Calden, of Hydraulic Press Sales Staff, Birdsboro Steel Foundry & Machine Co.

CHARLES L. HUSTON, JR., formerly assistant staff supervisor of employment with the American Rolling Mill Co., Middletown, Ohio, has joined the Lukens Steel Co., Coatesville, Pa., as director of personnel. He will have charge of the personnel activities of the Lukens Steel Co. and its divisions By-Products Steel Corporation and Lukenweld, Inc.

MEEHANITE METAL CORPORATION, Pittsburgh, Pa., has granted manufacturing licenses to the Vancouver Engineering Works, Ltd., Vancouver, B. C., Canada, and to the Washington Machinery & Supply Co., Spokane, Wash.

R. CARSON DALZELL has been appointed technical adviser to the Revere Copper & Brass, Inc., Baltimore Division, with headquarters at 1301 Wicomico St., Baltimore, Md. Mr. Dalzell is a graduate in electrical engineering of Johns Hopkins University, 1927; in 1929, he received the degree of Doctor of Science in metallurgy at Harvard University. He has since been engaged in research work with several industrial corporations.

Wisconsin and Michigan

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., has established a new branch office in the U. S. Trust Bldg., Louisville, Ky., with W. E. KERCHEVAL in charge, and another new branch office at LaPorte, Ind., with B. L. MARGESON in charge.

CHAIN BELT CO., Milwaukee, Wis., has acquired the business and assets of the BALDWIN-DUCKWORTH CHAIN CORPORATION, Springfield, Mass. The plan of acquisition is, in effect, a merger of the two long established companies.

JOHN S. BARTEK has rejoined the engineering staff of the Pioneer Engineering & Mfg. Co., 31 Melbourne Ave., Detroit, Mich. He was until recently chief engineer of the Modern Tool Works, Rochester, N. Y., and previous to that connection was with the Pioneer Engineering & Mfg. Co.

ODEL TOOL & DIE CO., formerly at 4670 Algonquin Ave., Detroit, Mich., has built a new plant located at 8820 Grinnell Ave., Detroit. The company specializes in molds for die-castings and small sheet-metal dies, and also does experimental work and short-run production jobs.

Drafting Department Efficiency Improved by Air-Conditioning

An improvement of over 50 per cent in the summer output of the drafting-room of the Detroit Edison Co. is claimed as a result of housing the drafting-room in a new air-conditioned windowless office. This building is a radical departure from conventional design. It is entirely without windows, six stories high, and covers an area of 250 by 120 feet. Daylight enters each floor through a band of glass bricks around the building. Supplementary light is provided by an electric lighting system that insures an illumination of fifty foot-candles at the desk tops.

The air-conditioning and high-intensity lighting permitted the design of a rectangular building without the courts usually employed to bring daylight and natural ventilation to all working areas. The six-story building, therefore, contains as much usable space as a conventional eight-story building without air-conditioning, so that the cost of air-conditioning is more than offset by the savings made possible in construction and maintenance.

In accounting for the great gain in efficiency, many small items, all of which are time-consuming, are mentioned. Tracing paper, for example, in the ordinary drafting-room may be blown to the floor by the draft from an open window; paper on the board will get dirty from the same source and have to be cleaned; and smudges on the paper will have to be erased. Avoiding these many small inconveniences and distractions accounts for a considerable saving in the time of doing a piece of work. The comfort of the workers in the air-conditioned drafting-room is, however, the main factor in contributing to the greater efficiency.

* * *

Lincoln Electric Announces Price Policy

The Lincoln Electric Co., Cleveland, Ohio, has announced that the company intends, during the impending world crisis, to maintain present prices as far as possible. If the materials bought by the company increase in price or the cost of labor rises, the company will raise selling prices no more than the bare increase in cost of materials and labor going into Lincoln products.

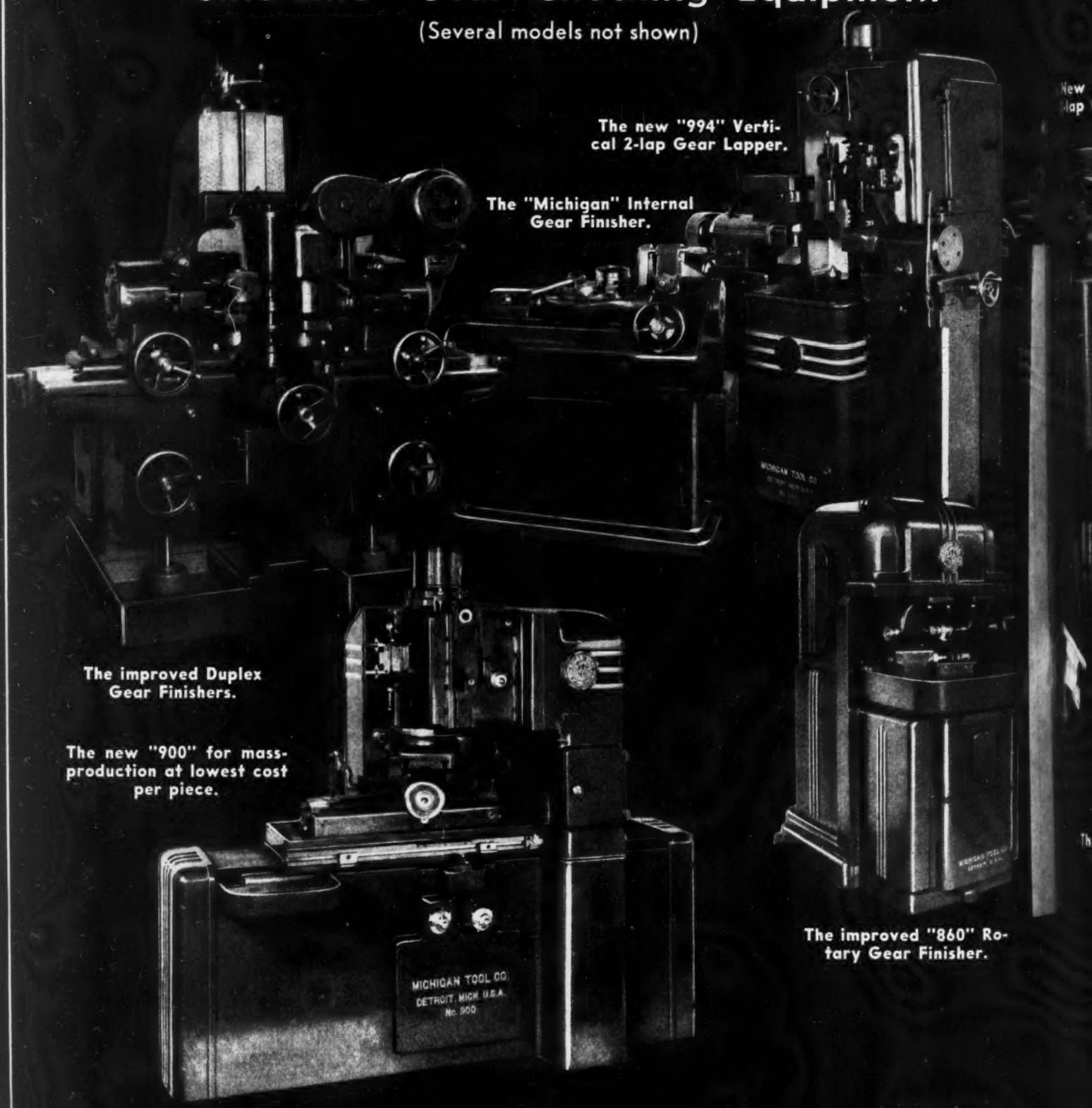
* * *

According to the Society of Automotive Engineers, it is estimated that the unfilled orders in the aircraft industry amount to more than $275,000,000, a figure that may rapidly increase, due to the contracts for aircraft still expected to be placed by the Government.

Better Gears? Here is y

The Complete New Line of "Michigan" Gear Finishers, Gear Lappers and "Sine-Line" Gear Checking Equipment

(Several models not shown)



The new "994" Vertical 2-lap Gear Lapper.

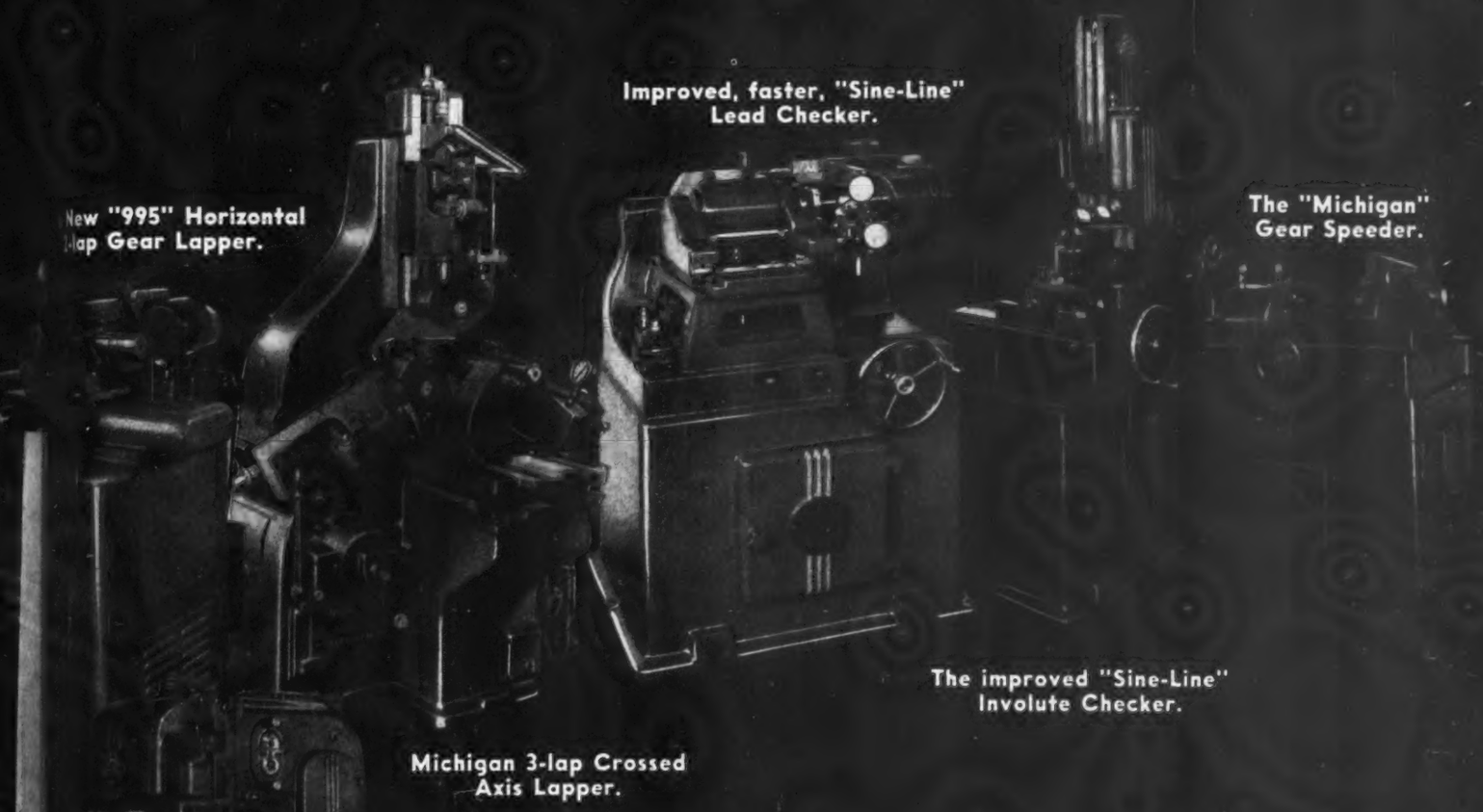
The "Michigan" Internal Gear Finisher.

The improved Duplex Gear Finishers.

The new "900" for mass-production at lowest cost per piece.

The improved "860" Rotary Gear Finisher.

s your answer...



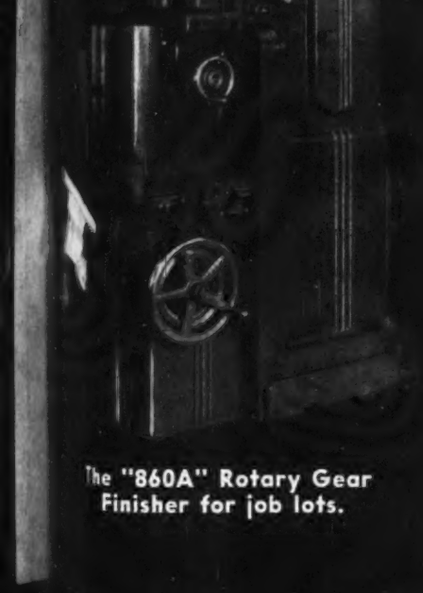
New "995" Horizontal Lap Gear Lapper.

Improved, faster, "Sine-Line" Lead Checker.

The "Michigan" Gear Speeder.

The improved "Sine-Line" Involute Checker.

Michigan 3-lap Crossed Axis Lapper.



The "860A" Rotary Gear Finisher for job lots.

2 Reasons why more gears are finished on Michigans than on all other makes combined:

1. Michigans produce better gears at LOWER cost;
2. There's a model to fit virtually every production set-up.

(Catalog on Request)

Ask us about "Curve-Shaving" (Bulletin No. 150) and "Cone-Drive" Worm Gearing (Bulletin No. 148).

MICHIGAN TOOL COMPANY

7171 E. McNichols Road - - - - - - Detroit, Michigan

COMING EVENTS

OCTOBER 5—Annual convention of the ASSOCIATED MACHINE TOOL DEALERS OF AMERICA at the Hotel Cleveland, Cleveland, Ohio. Thomas A. Fernley, Jr., executive secretary, 505 Arch St., Philadelphia, Pa.

OCTOBER 5-7—National aircraft production meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 6-7—Annual meeting of the FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION at the Greenbrier Hotel, White Sulphur Springs, W. Va. Executive secretary, Arthur J. Tuscany, Penton Bldg., Cleveland, Ohio.

OCTOBER 15-21—Fortieth annual NATIONAL AUTOMOBILE SHOW, to be held at the Grand Central Palace, New York City. Further information can be obtained from the Automobile Manufacturers Association, General Motors Bldg., Detroit, Mich.

OCTOBER 16-18—Twenty-second semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Whitcomb Sulphur Springs, St. Joseph, Mich. J. C. McQuiston, manager-secretary, 602 Shields Bldg., Wilkensburg, Pa.

OCTOBER 16-20—NATIONAL SAFETY CONGRESS AND EXPOSITION in Atlantic City, N. J. For further information, address the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 23-27—NATIONAL METAL EXPOSITION to be held in conjunction with the annual meeting of the AMERICAN SOCIETY FOR METALS in the International Amphitheater, Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 1-3—Annual meeting of the MEEHANITE RESEARCH INSTITUTE OF AMERICA, INC., at the Hotel Statler, Detroit, Mich. Headquarters of the Institute, 311 Ross St., Pittsburgh, Pa.

NOVEMBER 3-4—NATIONAL MOTION AND TIME STUDY CLINIC to be held at the Medinah Club, Chicago, Ill., under the auspices of the Industrial Management Society, 205 W. Wacker Drive, Chicago, Ill.

DECEMBER 4-8—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Bellevue-Stratford Hotel, Philadelphia, Pa. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 4-9 — Seventeenth EXPOSITION OF CHEMICAL INDUSTRIES in the Grand Central Palace, New York City. For further information, apply to Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

JANUARY 15-19, 1940—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MAY 6-10—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in Chicago, Ill., with exhibits at the International Amphitheater, and headquarters of the convention at the Palmer House. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

* * *

How Long Can Taxes Continue to Grow?

The rise in taxes during recent years in the United States has been at a rate far greater than in the United Kingdom, generally believed by its inhabitants to be the most heavily taxed country in the world. According to a compilation prepared by the National Association of Manufacturers, taxes have increased 430 per cent in the United Kingdom since 1913, while in the United States taxes have increased 640 per cent during the same period. This includes all national and local taxes in the United Kingdom and all federal, state, and local taxes in the United States.

A most important point in this comparison, however, is that, while the United Kingdom has operated on a substantially balanced budget, with government revenues practically equal to government expenditures, the United States, during the last seven years, has followed an entirely different policy. The national debt of Great Britain will have risen slightly more than $4,700,000,000 in the ten years ending with the calendar year 1939, while our federal debt has risen $27,000,000,000 in the same period. In other words, not only have we increased our current taxes at a ratio far greater than the increase in Great Britain, but we have also added nearly six times as much as Great Britain for the taxpayers to pay in the future.

Now that Great Britain is engaged in war, it is, of course, to be expected that her national debt will rise sharply; but the comparison above relates to the United States and Great Britain while both were at peace, and covers also that recent period during which Great Britain spent enormous sums to prepare for what proved to be an inevitable conflict, making the comparison direct and reasonable.

OBITUARY

Charles M. Schwab

Charles M. Schwab, chairman of the board of the Bethlehem Steel Corporation and for the last forty years one of the most outstanding men in the American steel industry, died Monday, September 18, at his home at 290 Park Ave., New York City, aged seventy-seven years.

Mr. Schwab's career was one of the most spectacular in American industrial history. Born in Williamsburg, Pa., in 1862, he got a job at the age of sixteen as sweeper and general utility boy in a store in Braddock, Pa. The next year, we find him in the Edgar Thomson Steel Works as a laborer in the engineering corps. He was barely twenty when he was made chief engineer and assistant to the general manager of the steel works; and when he was twenty-five, he was made superintendent of the Homestead Steel Works by Andrew Carnegie. Two years later he was made general superintendent of the Edgar Thomson Steel Works which he had entered ten years previously as a seventeen-year-old laborer. At the age of thirty-five, he became president of the Carnegie Steel Co., Ltd., and, at thirty-nine, the first president of the U. S. Steel Corporation, of which he was one of the founders.

In 1905, he left the U. S. Steel Corporation to become president and chairman of the board of the Bethlehem Steel Co., in which he had acquired a interest. At the time that Mr. Schwab became interested in the Bethlehem Steel Co., it was an enterprise valued at about $15,000,000. In 1930, this company became the Bethlehem Steel Corporation, with assets of nearly $750,000,000 and annual sales above $260,000,000. It is said that in 1914 Mr. Schwab, whose family came from Baden Baden in Germany, refused an offer of $100,000,000 from the German Government if he would agree not to sell ordnance to Great Britain or the allied countries.

When America entered the World War, Mr. Schwab was appointed director general of the Emergency Fleet Corporation by President Wilson. In 1927, he was president of the American Society of Mechanical Engineers, and from 1927 to 1932, president of the American Iron and Steel Institute. In 1928, he was awarded the Bessemer Medal by the Iron and Steel Institute of Great Britain.

Once Mr. Schwab was asked to what he ascribed his rapid rise in industry. He answered that he was neither a particularly good engineer nor outstanding as a business man, but that he thought he possessed the gift of making friends.

"MODERN" MEANS MORE THAN MERELY "NEW" IN THE DESIGN OF MILWAUKEE MILLING MACHINES

CHANGES and developments in milling machine design must be more than merely "new" to measure up to the K&T concept of what is "modern" . . . If the "new" offers definite improvements in performance — proven by exacting tests on actual work — K&T engineers pass on these benefits to milling machine users . . . Only by such careful analysis and practical tests can basic progress in milling machine design be made . . . Concentrating on the building of milling machines exclusively—for more than 41 years—has won for the Kearney & Trecker Corp. world-wide recognition for the most advanced milling machine design and construction.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

PROFIT MORE WITH K&T PRODUCTS

K&T

Milwaukee **MILLING MACHINES**

NEW BOOKS AND PUBLICATIONS

MODERN BLAST-CLEANING AND VENTILATION. By C. A. Reams. 213 pages, 6 by 9 inches. Published by the Penton Publishing Co., Cleveland, Ohio. Price, $4.

The cleaning of metallic surfaces, particularly of castings, is closely related to production in almost all metal industries. Blast-cleaning has been the outgrowth of sand-blasting and has today become an important factor in the art of cleaning metals. Heretofore, there has been no handbook covering the entire field of blast-cleaning and its allied equipment. The present book, therefore, has been prepared to serve industry by presenting, in one volume, information not previously available. The subject is comprehensively covered. The best idea of the contents can be given by quoting the chapter heads: Development of Blast-Cleaning; Abrasives; Principles of Compressed-Air Blast-Cleaning; Abrasive Recovery and Separation; Nozzles; Abrasive Lines; Compressed Air-Blast Cleaning; Moisture in Compressed Air; Manual Type Blast Equipment; Blast Rooms; Barrel Type Blast Equipment; Table Type Blast Equipment; Automatic Blast Equipment; Installation of Compressors and Accessory Equipment; Low-Pressure Blasting; Centrifugal Blasting; Centrifugal Wheel Blast Machines; Increase of Fatigue Resistance of Metal by Surface Blasting; Ventilation; Reduction of Industrial Hazards; Hydroblasting; Maintaining Blast-Cleaning Equipment; Foreign Blast-Cleaning Developments; Selecting Blast-Cleaning Equipment; Blast-Cleaning of Rolled Steel; Blast-Finishing of Cold Mill Rolls; Blast-Cleaning of Forgings; Blast-Cleaning in the Porcelain Enameling Industry; Railway-Car Blast-Cleaning; Blast-Cleaning Special Alloys and Tools; Preparation of Metal Surfaces for Metal Coating.

THE OPEN-HEARTH FURNACE—ITS DESIGN, CONSTRUCTION AND PRACTICE. (Volume 3). By William C. Buell, Jr. 308 pages, 6 by 9 inches. Published by the Penton Publishing Co., Cleveland, Ohio. Price, $4.

The three volumes of this work complete a treatise on open-hearth furnaces. The first volume, previously published, covered the theory of heat flow effects through furnace refractories, heat transfer problems, and selected furnace designs. The second volume dealt with the metallurgical, chemical, and thermal factors of operation that affect design; with open-hearth heat balances; and with detailed design of the furnace ends.

The present volume consists, first, of a comparison of the ancillary systems of selected existing open-hearth furnaces and the development of basic design principles. It further deals with checker work and recuperative and regenerative effects, as well as flues, valves, and waste-heat boilers. Briefly, the various chapters deal with Fluid Flow in Ancillary System; Typical Slag Pockets; Design of Open-Hearth Slag Pockets; Typical Fantails; Design of Open-Hearth Fantails; Typical Regenerator Chambers; Connecting Flues; Design of Open-Hearth Regenerator Chambers; Distribution and Flow of Fluids in Regenerator Chambers; Checker Work for Open-Hearth Furnaces; Heat Exchange in Regenerators; Flues for Open-Hearth Furnaces; Valves for Open-Hearth Furnaces; Waste-Heat Boilers; Open-Hearth Furnace Control; Flow Diagrams.

SYMPOSIUM ON PATENTS. 121 pages, 6 by 9 inches, containing matter presented at the Symposium held under the auspices of the Federal Bar Association of New York, New Jersey, and Connecticut, at the Federal Court House, New York City, May 2 to 3, 1939. Obtainable from Anthony William Deller, 67 Wall St., New York City.

FATIGUE TESTS OF BUTT WELDS IN STRUCTURAL STEEL PLATES. By Wilbur M. Wilson and Arthur B. Wilder. 58 pages, 6 by 9 inches. Published as Bulletin No. 310 of the Engineering Experiment Station, by the University of Illinois, Urbana, Ill. Price, 65 cents.

VISION AND INDUSTRIAL EYE PROTECTION: A SYMPOSIUM. By Leonard Greenburg, M.D. 23 pages, 6 by 9 inches. Publication 299 of the National Society for the Prevention of Blindness, Inc., 50 W. 50th St., New York City. Price, 15 cents.

* * *

Simplified Practice Recommendation on Grinding Wheels

The Division of Simplified Practice of the National Bureau of Standards has announced that printed copies of the revision of Simplified Practice Recommendation R45, covering grinding wheels, are now available. This revision was effective June 1, 1939. Copies of the recommendation may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

* * *

Volume of Gear Business Indicates Business Improvement

The American Gear Manufacturers Association, 602 Shields Bldg., Wilkinsburg, Pa., representing the gear-manufacturing industry in the United States, reports that gear sales for August were 7 per cent above those for July, and 26 per cent above those for August, 1938. The eight months ending with August this year show a gain of 21.5 per cent over the same period last year.

* * *

Triplex Machine Tool Show

The Triplex Machine Tool Corporation, 125 Barclay St., New York City, has decided to hold its own machine tool show in its newly opened showroom at 106 Lafayette St., New York. The show will be open October 2 to 14, inclusive, from 9 A.M. to 10 P.M. There will be about forty-five machine tools on display, all being demonstrated. After the show is closed, there will be a permanent exhibition of machines from 9 A.M. to 5:30 P.M. daily.

Triplex Machine Tool Corporation Conducts Its Own Machine Tool Show in Its Recently Opened Showroom at 106 Lafayette St., New York, October 2 to 14